Report:

Site Investigation at the Avery Dennison Fasson Roll Division Facility

Quakertown, Pennsylvania

Prepared for Avery Dennison Corporation

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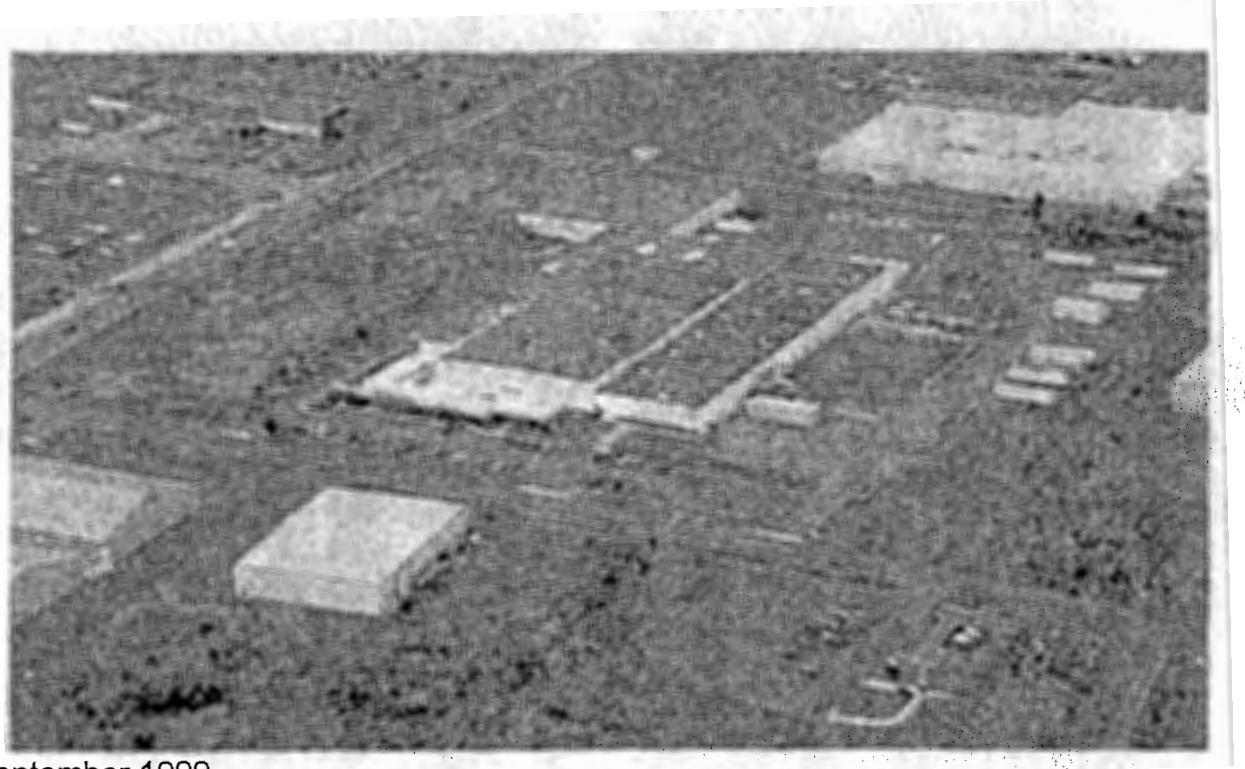

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ENSR

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EXECUTIVE SUMMARY

ENSR Corporation was contracted by Avery Dennison-Quakertown to perform a supplemental site investigation program at the Fasson Roll Division facility located at 35 Penn Am Drive, Richland Township, Bucks County, Pennsylvania. The supplemental investigation was performed in accordance with ENSR's proposal dated November 13, 1998. The purpose of the supplemental investigation was to (1) determine the nature and extent of residual chemicals that may remain in the soils and groundwater in the southeast portion of the property and (2) to identify potential risks to human health and the environment posed by such residual chemicals, if present.

A field screening program was completed in the vicinity of the former source area(s) to establish the mass and volume of residual soil, and to assist in the location additional monitoring wells. ENSR established a grid system in the vicinity of the former source area(s) to systematically identify the presence of residual contaminant zones. Soil samples were collected and analyzed in the field by an experienced chemist using a portable field GC. Soil samples were submitted to Lancaster Laboratories to confirm the results of the field GC screening, as well as to satisfy PADEP requirements for site investigations. A total of four soil samples and two QA/QC samples were submitted to the laboratory and analyzed for Target Compound List Volatile Organic Compounds (TCL VOCs) by EPA Method SW-846 5035/8260B, Target Compound List Semivolatile Organic Compounds (TCL SVOCs) by EPA Method 8270C, and percent moisture. All soil samples analyzed during the course of the investigation were below Pennsylvania's Statewide Health Standards. Therefore, no further action is proposed for the soils in the vicinity of the former solvent recovery and underground tank systems near the southeast corner of the property.

Due to the potential for present long-screened monitoring wells to serve as a conduit for future contamination of previously uncontaminated portions of the aquifer, ENSR recommended the modification of several existing monitoring wells. Well screens were set from 45 to 55 feet below the ground surface in each retrofitted well. Once the existing well screens were removed from the boreholes, each well was retrofitted with two-inch diameter PVC casing and ten feet of 0.010 factory-slotted PVC well screen. The documentation of any potential stratification of groundwater contaminants was a critical element of the supplemental investigation. Therefore, adjacent to each retrofitted monitoring well, a shallow monitoring well was installed. Five monitoring wells were also abandoned during the supplemental site investigation. The wells abandoned were selected because analytical results from these wells have always been below Pennsylvania's Medium-Specific Concentrations for Organic Regulated Substances in Groundwater for Used Aquifers.

Each well was sampled for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). ENSR also sampled the wells for pH, dissolved oxygen, nitrate, ferrous iron, sulfate, and methane for potential use in the evaluation of natural attenuation as the preferred remedy, if

necessary. VOCs were not detected in any monitoring well. With respect to the SVOCs, two constituents were detected; fluorene and bis (2-ethylhexyl)phthalate. Fluorene was detected in monitoring well MW-5D at an estimated concentration of 3 µg/L. However, this concentration is well below the Statewide Health Standard MSC of 190 µg/L for aquifers that are designated suitable for drinking water purposes. Bis (2-ethylhexyl) phthalate was detected slightly above the Statewide Health Standard MSC of 6 µg/L in all five of the newly-installed deep retrofitted monitoring wells. This phthalate ester, which is a common laboratory artifact, however was not detected in the shallow monitoring wells, nor was it detected in the duplicate sample obtained from monitoring well MW-12D. ENSR believes that the low levels of bis (2-ethylhexyl) phthalate may be an artifact related to laboratory or field sampling methods, as phthalate esters were not detected in the blind duplicate sample submitted to the laboratory, nor were phthalate esters used by the facility. We will be able to conclude this fact with an additional round of well sampling using a stringent sampling protocol.

Prior to formally submitting the Final Report to PADEP in accordance with Act 2 to attain a release from liability for future cleanup obligations in the areas investigated, ENSR recommends that a confirmation round of groundwater sampling be conducted for VOCs and SVOCs.

1 INTRODUCTION

ENSR Corporation, an international environmental consultant and engineering firm, was contracted by Avery Dennison Corporation (Avery Dennison) to perform a supplemental site investigation program at the Avery Dennison Fasson Roll Division facility located at 35 Penn Am Drive, Richland Township, Bucks County, Pennsylvania. The supplemental investigation was performed in accordance with ENSR's proposal dated November 13, 1998.

1.1 Purpose of Investigation

The purpose of the supplemental investigation was twofold: (1) to determine the nature and extent of residual chemicals that may remain in the soils and groundwater in the southeast portion of the property; and (2) to identify potential risks to human health and the environment posed by such residual chemicals, if present.

Source area removal and groundwater pump and treat remedial actions were completed by Avery Dennison in the late 1980's and early 1990's to address the presence of toluene and low levels of low-weight aromatic hydrocarbons detected in groundwater near the southeast corner of the property. Analytical data from 13 on-site monitoring wells showed a marked improvement in groundwater quality by the time the groundwater pump and treatment system was dismantled in 1993. Although the previous soil and groundwater remediation efforts appear to have been successful in reducing contaminant levels to below regulatory actions levels (as discussed in Section 2 of this report), Avery Dennison never received formal closure from the Pennsylvania Department of Environmental Protection (PADEP) with respect to the remediation program. Now that Pennsylvania's Land Recycling and Environmental Standards Act (Act 2) is the appropriate legislative framework to be used in determining compliance with remediation action levels, Avery Dennison is seeking relief from liability for future cleanup obligations.

The unconventional monitoring well network and construction (i.e. extra-long well screens) used to measure the performance of the remediation prompted Avery Dennison to evaluate whether the existing monitoring well program was sufficient to satisfy the Technical Guidance for investigations conducted under Act 2. Avery Dennison, therefore, commissioned a supplemental investigation to revise the monitoring well network, definitively rule out the presence of residual contamination, and obtain closure under Act 2.

1.2 Facility Location

The property is located in close proximity to the Borough of Quakertown. As such, the property has a Quakertown mailing address and is referred to by Avery Dennison as the "Quakertown Facility." The Quakertown Facility encompasses approximately 17 acres of land at the intersection of Penn Am Drive and California Road in Richland Township, Bucks County, Pennsylvania. The Site location is depicted

on the Quakertown, Pennsylvania U.S.G.S. 7.5' Topographic Quadrangle, a portion of which is provided as Figure 1-1.

1.3 Current Site Use

Avery Dennison Corporation manufactures self-adhesive labeling materials for a wide range of consumer products at the Quakertown Facility. The facility was constructed in the early 1970's and has manufactured self-adhesive products since that time.

Consistent with Avery Dennison's pollution prevention and waste minimization policies, the Quakertown Facility is now designated as a "solvent-free" facility. Prior to 1998, Avery Dennison used adhesive products that included low molecular weight aromatic hydrocarbons in their formulation. Based on a review of material safety data sheets (MSDS) for the adhesive products formerly used by Avery Dennison, the principle hydrocarbon present in the adhesives was toluene; although n-heptane, benzene, acetates, ethylbenzene, and xylene were also present in trace quantities. Chlorinated solvents were never used at the Quakertown Facility.

1.4 Environmental Setting

The Avery Dennison facility is located within a light industrial park that includes a variety of businesses, ranging from asphalt shingle manufacturing (Georgia Pacific) and paper consumer products (Moore Business Forms), to small tool fabrication manufacturers and commercial professional services. The entire industrial park and much of the surrounding area are serviced by municipal water supplied by the Borough of Quakertown. The entire industrial park is also serviced by the Borough of Quakertown Wastewater Treatment Facility. As discussed in Section 3, according to Richland Township municipal records, several properties within ½ mile of the Quakertown Facility reportedly rely on private water supply wells. However, upon follow-up discussions with Mr. Michael Brzezecki, Superintendent of the Quakertown Water Company, all properties within ¼ mile of the Avery Dennison facility are connected to the municipal water supply.

The Avery Dennison facility is bordered to the north by Moore Corporation; to the east by a JG Furniture warehousing operation; to the south by Penn Am Drive, a YMCA and residential properties; and to the west by California Road and commercial properties. Aerial photographs included in Appendix A show the surrounding land use features.

Prior to the construction of the Avery Dennison facility in the 1970's, property to the north and east was already developed. To the north of the property, near the intersection of California and Pumping Station Roads, American Olean & Tile Company (purchased by Armstrong World Industries in the mid 1980's) manufactured ceramic-based tile products for consumer uses. Tile manufacturing ceased at the facility in the early 1990's, and the facility is now used for warehousing purposes. To the east of the Avery Dennison facility, JG Furniture operates a warehouse for finished furniture. To the east of the JG Furniture warehouse, lies property formerly operated by the Quakertown Brick and Tile

Company, Inc., which manufactured bricks from 1947 until the mid 1960's. The bricks, which were made from on-site materials, were noted for their strength due to the iron silicate content of the rock. The Triassic red shale of the Brunswick Lithofacies, the principal raw material, was obtained from a quarry near the plant. The red shale was ground, mixed with water, molded, cut, loaded on kiln carts, dried, and fired (Willard, 1959.)

1.5 Report Organization

After this introductory section, Section 2.0 provides a summary of the remedial actions that have been completed at the Site. Section 3.0 summarizes the hydrogeologic framework for the site. Section 4.0 summarizes the scope of work implemented, Section 5.0 provides a discussion of the analytical results, and Section 6.0 presents the conclusions and recommendations for future work at the Site.

2 AREAS OF CONCERN AND PREVIOUS REMEDIAL ACTIONS

2.1 West-Side Tank Farm Closure

Consistent with Avery Dennison's worldwide initiative to eliminate underground storage tanks at its manufacturing facilities, the underground adhesives tank farm formerly located on the west side of the facility was closed in the early 1990's. This tank farm was used by Avery Dennison to store adhesive products, which are now delivered to the site in totes. Most of the USTs, which ranged between 10,000 and 20,000 gallons in size, were removed from the ground, and were observed to be in good condition at the time of their removal. Several of the tanks, that were located partially beneath the facility structure, were cleaned and closed in-place due to structural concerns associated with the building. A small quantity of adhesive was observed released to the subsurface during the tank closure program. Due to the viscous nature of the adhesive, it was captured immediately and placed into drums for proper disposal. Results from groundwater monitoring wells installed in this area have shown that an impact to groundwater quality was not present. The former West-Side Tank Farm is not a source of soil or groundwater contamination at the site.

2.2 Fuel Oil UST Closure

Avery Dennison has relied on natural gas as the primary fuel for heating purposes at the Quakertown Facility since its construction. However, No. 4 fuel oil was used in winter for backup and supplemental heating depending on oil price and market conditions at the time. The No. 4 fuel oil was stored by Avery Dennison in a 20,000-gallon underground storage tank (UST) located in the southeast corner of the property, adjacent to the reclaimed solvent transfer tank. In October 1986, a rupture occurred in the fuel oil recirculation line, resulting in a discharge of approximately 600 gallons of No. 4 heating oil to the subsurface. A prompt response was initiated by Avery Dennison, which included the removal of the tank system, the excavation and off-site disposal of 1,400 cubic yards of soil, and the replacement of the UST system with a new 20,000 gallon tank.

In 1995, Avery Dennison acquired a "non-interruptable" service guarantee from the natural gas supplier. Because the new UST system was no longer necessary for plant operations, the tank system was eliminated shortly thereafter. During the removal of the replacement UST system in 1998 relic hydrocarbon (No. 4 fuel oil) from the 1986 line rupture was encountered. A prompt response was again initiated by Avery Dennison, and approximately 100 cubic yards of additional soil were removed and disposed off-site at a licensed, asphalt-batch recycling facility.

2.3 Solvent Recovery System Closure

Prior to 1998, Avery Dennison operated a solvent recovery unit in the southeast corner of the property. This solvent recovery system included three aboveground carbon adsorption beds, an associated cooling tower, and a 20,000-gallon underground reclaimed solvent transfer tank (situated adjacent to the 20,000 gallon No. 4 heating oil tank.) The solvent transfer tank was replaced in 1986 with a new 20,000-gallon UST, at the same time as the heating oil tank. This new 20,000-gallon tank was subsequently removed in 1998 when the Quakertown Facility became a solvent-free operation. There was no evidence of leakage from the solvent transfer tank system, and the tank and associated piping were observed to be in good condition during their removal in 1986, and during removal of the replacement tank system in 1998.

A condensate pump associated with the solvent recovery unit failed in January 1989, which allowed an aboveground condensate tank to overflow and flood the secondary containment vault near the northwest corner of the carbon adsorber beds. Approximately 70 gallons of condensate discharged to an adjacent sump which was connected to the storm sewer. Sorbent materials maintained in the storm drain outfall prevented the accidental release from migrating beyond the outfall. Avery Dennison installed a high-level alarm on the condensate collection tank to give warning of a future failure. The sump and surrounding soils were subsequently removed for proper disposal. The Bucks County Health Department provided oversight during the remedial actions and required no further action in correspondence dated October 24, 1986.

2.4 Groundwater Remediation System

The contemporaneous occurrence of constituents related to the condensate discharge from the solvent recovery unit and residual from a former underground No. 4 heating oil system are believed responsible for the dissolved-phase hydrocarbons detected in several groundwater monitoring wells located to the southeast and east of the facility. The presence of these constituents in groundwater was the basis for the pump and treat remediation system installed by Groundwater Technology, Inc. (GTI) in April 1989.

A groundwater pump and treat program was implemented in April 1989 to address the presence of toluene and trace levels of low-weight aromatic hydrocarbons. Ground water was initially pumped from recovery well RW-1, which was a 113-ft. deep bedrock recovery well. After three months of RW-1 operation, laboratory analytical results showed contaminant concentrations to be below method detection limits. In response to this development, GTI initiated ground water pumping from monitoring well MW-4 in August 1989. MW-4 was completed to a depth of 55 feet below the ground surface. Pumping from MW-4 at a rate of approximately 1 gallon per minute (gpm) continued until November 1992. Over 600,000 gallons of groundwater were pumped from MW-4 and treated by GTI using an on-site air stripping tower. The treated effluent was discharged to the Borough of Quakertown wastewater treatment facility in accordance with a pretreatment discharge permit.

Prior to the onset of groundwater remediation, toluene was detected at a concentration of 88,200 µg/L. Low concentrations of benzene (8 µg/L), n-heptane (2,600 µg/L), ethylbenzene (240 µg/L), and total xylenes (810 µg/L) were also detected. These findings were consistent with GTI's theory that the condensate from the former solvent recovery system was the probable source of the aromatic hydrocarbons in the groundwater.

Periodic groundwater monitoring was completed at the site by GTI to measure the system performance. Based on the groundwater quality monitoring results, which showed a substantial improvement in groundwater quality, GTI submitted a petition for closure to PADEP. The PADEP conditionally accepted the conclusions set forth in GTI's June 1991 Site Closure Request. As part of the closure agreement, PADEP required one additional sampling round for monitoring wells MW-4, MW-7 and MW-8. The results of the additional sampling round showed toluene in excess of 1,000 µg/L, which was the Maximum Contaminant Level (MCL) in 1991. The current Medium-Specific Concentration (MSC) for toluene in groundwater under Pennsylvania's Land Recycling Program is also 1,000 µg/L. All other results were less than the method detection limit for each constituent analyzed.

Based on the presence of 1,300 µg/L of toluene detected in MW-4 during March 1992, Avery Dennison proposed to continue pumping from the recovery well (MW-4) and conduct periodic sampling. Additional sampling of MW-4 in October and November 1992 showed the concentration of toluene (and other constituents) to be less than the method detection limit. GTI interpreted the 1,300 µg/L of toluene detected in March 1992 as resulting from the flushing of residual adsorbed constituents from the vadose and unconsolidated saturated zones. GTI concluded that there was no data indicating a continuing source of toluene. Based on the continued natural degradation and attenuation processes occurring in the subsurface, GIT recommended no further action.

2.5 Constituents of Concern

Chemical usage at the Avery Dennison facility has decreased significantly over the last decade. The facility is now recognized as a "solvent-free" facility. Historical chemical usage at the site was limited to fuel oil usage, routine equipment maintenance, and low-weight aromatic hydrocarbons associated with the facility's adhesive formulations.

Condensate from a former solvent recovery system and petroleum residual from a former underground No. 4 heating oil system are believed responsible for the dissolved-phase hydrocarbons detected in several groundwater monitoring wells located to the southeast and east of the facility. The principle hydrocarbon detected in the monitoring wells appears to be toluene. However, trace levels of benzene, ethylbenzene, total xylenes, and n-heptane have also been detected in the groundwater.

Figure 2-1 provides a map of the site showing the areas of concern and other site features. Figure 2-2 provides the current conceptual model of the site, which included the two suspected source areas and the site-specific conditions affecting the fate and transport of potential constituents.

3 HYDROGEOLOGIC FRAMEWORK

3.1 Physiography and Topography

The Avery Dennison Quakertown facility is located within the Piedmont Physiographic Province. The area is characterized by flat to rolling terrain, locally dissected by drainage features that are part of the Tohickon Creek drainage basin. The Quakertown facility lies approximately 520 feet above mean sea level on flat terrain. Surface drainage at the site appears to be divided. Surface drainage on the northern half of the property is to the northeast. Surface drainage on the southern half of the property is toward the southeast, consistent with the dendritic drainage pattern of the Tohickon Creek and its many unnamed tributaries. The Tohickon Creek is a tributary of the Delaware River.

A wetlands area, located to the south of Penn Am Drive, provides an area of recharge for a small, unnamed tributary of the Tohickon Creek. Although water was not observed in the wetlands or unnamed tributary during the course of ENSR's investigation, during periods of extended rainfall, standing or flowing water is known to exist. During extended periods of rainfall, the unnamed tributary flows south toward residential areas, where it enters a concrete culvert, passes under Brookfield Circle (a residential development constructed in the mid to late 1960's, and discharges to Licken Run, a tributary of the Tohickon Creek.

As shown in Figure 3-1, thirteen (13) properties with private wells were identified by Richland Township to exist within ½ mile of the facility, and three municipal water supply wells (Quakertown Water Company) were identified to the north-northeast on Pumping Station Road approximately ¾ mile away. ENSR identified all of the Tax Parcels within ½ mile of the facility, and contacted Richland Township regarding the status of their water supply. A computer generated print-out of these parcels was provided to ENSR, which identified the 13 properties that reportedly operate private wells. However, based on our understanding of the water distribution network, provided to California Road customers by the Quakertown Water Company, it is was believed that Richland Township's records are outdated. We have contacted the Quakertown Water Company to verify this information. On June 9, 1999, ENSR contacted Mr. Michael Brzezecki of the Quakertown Water Company. Mr. Brzezecki confirmed that Richland Township records were most definitely outdated. The nearest water supply well to the Avery Dennison facility is located on West Pumping Station Road, greater than ¼ mile northwest of the site.

3.2 Regional and Local Geology

As shown in Figure 3-2, the geologic formations in the Quakertown area of varied lithology. All three categories of rock types, igneous, metamorphic, and sedimentary, are present regionally. The chief igneous rocks are the basic intrusives, most of which are Triassic in age. Approximately 80% of the region, including the Avery Dennison site, are underlain by rocks of the Newark Group. They are part

of the same Triassic rocks which extend from the west bank of the Hudson River in southeastern New York State, across New Jersey, southeastern Pennsylvania and central Maryland, into northern Virginia.

The Triassic rocks are often cut by unusually large normal faults that cause a repetition of strata. The Triassic rocks of Bucks County contain a larger proportion of shale to sandstone than is found in most areas of the Newark Group. The higher shale content translates into a lower aquifer transmissivity.

The regional geologic structure of the underlying bedrock consists of fault blocks that are tilted to the northwest anywhere from 5° to 20°. However, the rocks underlying the Quakertown area tend to deviate from this model due to general synclinal warping of the strata near fault zones and diabase intrusions, such as those present between Reservoir and Pumping Station Roads just north of the site. This may explain the southerly groundwater flow direction observed on the Avery Dennison property. Northeast of Quakertown the rock dips to the northwest; southwest of town it dips to the north. Due west of Quakertown, in the village of Spinnerstown, the bedrock dips to the northeast.

3.3 Site Geology

Weathered and fractured shale of the Brunswick Shale Lithofacies (Newark Group) underlie the Avery Dennison facility. Up to ten feet of clay loam derived from the underlying rock overlies the bedrock at the site. The well and soil boring logs provided in Appendices B and C provide the basis for the fence diagram of site geologic conditions portrayed in Figure 3-3.

3.4 Site Hydrogeology

Loam, weathered shale and clay, and thinly-bedded fractured shale of the Brunswick Shale Lithofacies underlie the site. Shallow groundwater within the shale appears to be under unconfined conditions. However, anisotropic conditions exist locally as evident from differences in water level measurements between the shallow and deeper wells of the same well couplet. Perched groundwater conditions are also known to exist locally in the weathered zone as a result of the low infiltration capacity of the shale.

Groundwater flow in the vicinity of the areas investigated is generally to the south toward the wetland area on the opposite side of Penn Am Drive. However, as shown in Figures 3-4 through 3-7, groundwater flow directions are complex as a result of anisotropic conditions in the underlying bedrock. Regardless of the groundwater flow directions, the existing monitoring well network is acceptable for groundwater monitoring compliance purposes.

A slight hydraulic gradient in the downward direction was evident during both rounds of synoptic water level measurements.

The groundwater elevations and flow directions reported for the deeper zone on March 22, 1999 appear anomalous. A groundwater depression was observed in the former source area (MW-12D),

and a groundwater rise was observed in MW-7D. An additional round of synoptic water level measurements was obtained on July 22, 1999, the results of which are shown on Figures 3-8 and 3-9. The impact of extreme drought on groundwater table elevations during July 1999 is clearly shown in the water elevation data. The water table is almost five feet lower than was observed in April 1999. As with the March and April 1999 elevations, the potentiometric surface within the shallow and deep zones in July 1999 is complicated as a result of anisotropic conditions in the underlying bedrock. A groundwater depression was observed in the deep zone near the former source area (MW-12D), and a groundwater rise was observed in the shallow zone in the same former source area Additional rounds of water level measurements will be collected during the proposed confirmation sampling of site monitoring wells.

4 SCOPE OF WORK

4.1 Objective

One of the primary objectives of the field investigation was to obtain the necessary information to demonstrate compliance with any, or a combination, of the three environmental remediation standards set forth under Pennsylvania's Act 2 (i.e. the Background Standard; the Statewide Health Standard; and/or the Site-Specific Standard.)

Of particular concern to Avery Dennison was whether the existing monitoring well network, and peculiarities in their construction (i.e. extra-long well screens) was sufficient to satisfy the Technical Guidance for investigations conducted under Act 2. Aside from monitoring well screen lengths that could be considered by PADEP to be incompatible with their Groundwater Monitoring Guidance Manual, the existing well spacing was also suspected to be overly conservative for use in defining contaminant gradients and documenting lines of evidence for natural attenuation, if necessary.

Given that Subchapter D of the Act 2 regulations prescribes a methodology to develop site-specific standards that are protective of human health and the environment, Avery Dennison also sought a revised site characterization program that defined the nature and distribution of residual contaminants, as well as the extent of any groundwater contaminant plume and its potential impact on sensitive receptors.

4.2 Field Preparation

Several preliminary tasks were completed by ENSR in preparation for the field investigation. These tasks included the evaluation of all previous environmental assessments and historical documentation related to the areas of concern, the notification of owners of underground utilities in the area, and the preparation of a comprehensive Health and Safety Plan (HASP.)

4.2.1 Review of Avery Dennison Records

The review was completed by ENSR personnel in the offices of Avery Dennison. The review included Material Safety Data Sheets (MSDS) to document the solvent usage and recovery history, as well as to rule out the use of chlorinated solvents at the facility that would have a bearing on well construction. Although chlorinated solvents were not used at the facility, the groundwater sampling program included the halogenated fraction in the volatile organic scan.

4.2.2 Local Utility Mark-Out

Within five business days of initiating field work, ENSR contacted Pennsylvania One-Call to notify owners of underground utilities that subsurface work would begin. All underground utilities were marked prior to ENSR's arrival on-site.

4.2.3 Health and Safety Plan

A comprehensive HASP was established by ENSR prior to initiating work at the Quakertown Plant. The plan, which addressed Avery Dennison's contractor safety requirements, identified the expected contaminants of concern, the level of personal protective equipment, environmental hazards monitoring equipment and instrumentation, decontamination procedures, and a contingency plan in accordance with the provision of OSHA 29 CFR 1910.120. A copy of the HASP is included as Appendix D.

4.3 Field Methodologies

4.3.1 Streamlined Field Screening Methods

A field screening program was completed in the vicinity of the former source area(s) to establish the mass and volume of residual soil, and to assist in the location additional monitoring wells. Since the constituents of concern were identified to be low molecular-weight hydrocarbons, their potential presence in the subsurface was considered conducive to the use of field screening methods.

ENSR established a grid system in the vicinity of the former source area(s) to systematically identify the presence of residual contaminant zones. Soil samples were collected and analyzed in the field for toluene by an experience chemist using a portable field GC.

4.3.2 Soil Sampling Methodology

The soil boring program involved the collection of soil and groundwater samples using direct push technology methods (Geoprobe). The samples were analyzed in the field by a trained ENSR chemist using a portable gas chromatograph (GC). The GC was equipped with a flame ionization detector (FID) to detect light weight aromatic hydrocarbons.

ENSR established a grid on 30 foot centers in the former source area(s). This systematic approach assisted in ENSR's field decisions regarding the selection of subsequent sample locations, and was critical in the optimal placement of additional monitoring well couplets.

Soil samples were submitted to Lancaster Laboratories to confirm the results of the field GC screening, as well as to satisfy PADEP requirements for site investigations. A total of four soil samples and two

QA/QC samples were submitted to the laboratory and analyzed for Target Compound List Volatile Organic Compounds (TCL VOCs) by EPA Method SW-846 5035/8260B, Target Compound List Semivolatile Organic Compounds (TCL SVOCs) by EPA Method 8270C, and percent moisture.

The following SOP was followed for the soil screening program:

Soil samples were prepared for analysis in the field by placing approximately 10 grams of soil into a tared 40 mL screw cap vial which contains 15 mL of organic-free water. The amount of soil added to the vial was adjusted so that the head space of the sample equals that of the standard (20 µL). The extraction vessel was then shaken vigorously for one minute to aid in breaking up the soil and increase the soil surface area exposed. The prepared sample was then heated to 40° C in a portable laboratory oven for 10 minutes.

Approximately 10 mL of head space from above the soil sample was then withdrawn through the vial septum with a Hamilton gas-tight syringe, and injected into the calibrated GC. An SP-1000 fused silica capillary column will provide separation of the volatile compounds on the GC system. The GC will be operated at a constant temperature (50° C) and at an approximate flow rate of 1.5 mL/min. The GC library identification capability will be over-ridden to allow manual interpretation and quantification by the experienced ENSR chemist assigned to the Avery project. Response area and retention time were tabulated for all chromatographic signals observed.

Qualitative identification of the compounds of interest were made by retention time (RT) matching of the sample chromatograms to those of the compounds in the standard chromatograms. Quantitation values were calculated based on the ratio of the response area of the compound identified in the sample to the response area of that compound in the standard.

4.3.3 Monitoring Well Retrofitting

PADEP recognizes the possibility for long-screened wells to serve as a conduit for future contamination of previously uncontaminated portions of the aquifer. As a result, PADEP typically requires wells of this construction to be sealed, or their construction modified to prevent this outcome.

ENSR identified existing monitoring wells MW-5, MW-6, MW-7, and MW-8 as candidates for modification, since their well screens were all 50 feet in length.

ENSR directed the driller (Advanced Drilling of Clinton, New Jersey) to pull the existing well screen and remove the sand pack from each well in preparation for a new monitoring well construction. One of the monitoring wells (MW-7) originally proposed for retrofitting was damaged during the removal of the well casing and screen. A decision was made to abandon this well, and install a new replacement well at an immediate adjacent location.

Well screens were set from 45 to 55 feet below the ground surface in each retrofitted well. The boreholes were retrofitted with two-inch diameter PVC casing and ten feet of 0.010 factory-slotted PVC well screen.

4.3.4 Monitoring Well Installation

The primary objective of the well installation program was to develop a three-dimensional model of the contaminant plume(s). This required the installation of well couplets, consisting of a weathered zone and competent zone monitoring well network.

Monitoring well installation in the Brunswick Shale Lithofacies requires experience and patience during the drilling process. It is not unusual for boreholes in this formation to appear dry during the drilling process, only to return to the site the next day and find a well casing full of water. The use of hastened drilling methods in fractured shale of low permeability often results in over-drilling the target zone. This appears to have happened at the Quakertown site, as evident by the extra-long well screens used in the former monitoring well construction. While it may be argued that the extra-long wells screens provided a bulk assessment of groundwater quality, wells with long screens provide very little information on the vertical distribution of the contaminants. The documentation of any potential stratification of groundwater contaminants was a critical element of the supplemental investigation.

ENSR's standard operating procedure for directing air rotary drilling in low-permeability formations, such as the one underlying the Quakertown facility, is to advance the borehole in ten foot increments and wait for 10-15 minutes between the first and second increment. If there is no evidence of water, the next ten feet is drilled, and the driller pauses again; this time for 30 minutes. If no water was encountered at this point, ENSR directed the driller to pull-off of the hole and begin a new hole. ENSR frequently inspected the boreholes for signs of groundwater seepage into the boreholes using a Solinst probe.

Once the final completion depth of each borehole has been established, the monitoring wells were constructed using unconsolidated well specifications. The wells were constructed of two-inch diameter PVC with no more than 10 feet of slotted PVC well screen. The wells were completed with flush-mounted protective well casings at Avery Dennison's request. All wells were equipped with brass locks.

Upon installation, each well was developed using a submersible pump and surge block technique until the development water exhibited a stable pH, temperature, and specific conductance.

The groundwater produced during well development and sampling was contained in 55-gallon drums and managed according to PADEP guidance for the disposition of materials generated during the course of site investigations. PADEP generally allows the discharge of development water to the ground surface if it is determined that the discharge will not impact any surface water body or cause environmental harm, or if the groundwater shows no obvious signs of contamination, such as odor,

color, or readings from monitoring instruments. However, due to Avery Dennison's good relationship with the Borough of Quakertown's POTW, direct discharge of the well development and groundwater sample purge water to the POTW was approved by the Borough of Quakertown upon receipt of sample results

4.3.5 Monitoring Well Abandonment

According to PADEP guidance, the installation of monitoring wells that are screened or open to relatively short vertical intervals within each target zone are necessary to resolve any stratification of contaminants and to establish vertical components of flow. This is particularly important should the need arise to perform 3-D computer modeling exercises to support a more rigorous risk assessment. Our experience has shown that PADEP prefers that bedrock monitoring wells be constructed with a minimal length of well screen (i.e. five to ten feet).

The five monitoring wells originally proposed for abandonment were selected largely because analytical results from these wells have always been below Pennsylvania's Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater for Used Aquifers. The undesirable construction (extra-long well screens) also contributed to the Avery Dennison's decision to abandon the wells, however.

Table 4-1 provides a summary of the well construction for each well at the Quakertown facility, including those wells that were abandoned.

Table 4-1
Monitoring Well Construction Summary

Well No.	*Screened Interval (ft.)*	*Status of Well*
RW-1	6.5 - 113	To be Abandoned
MW-1	4 - 49	Abandoned by ENSR
MW-2	4 - 74	Abandoned by ENSR
MW-3	5 - 55	Abandoned by ENSR
MW-4	5 - 55	Abandoned by GTI
MW-5S	3 - 15	New Installation by ENSR
MW-5D	45 -55	Former MW-5, Retrofitted Screen 45-55', Re-designated MW-5D.
MW-6S	10 - 20	New Installation by ENSR
MW-6D	45 - 55	Former MW-6 Retrofitted Screen 45-55', Re-designated MW-6D
MW-7	5 - 55	Abandoned Due to Unsuccessful Removal of Well Casing and Screen.
MW-7S	7 - 17	New Installation by ENSR
MW-7D	45 - 55	New Installation by ENSR
MW-8S	10 - 20	New Installation by ENSR
MW-8D	45 - 55	Former MW-8, Retrofitted Screen 45-55', Re-designated MW-8D
MW-9	5 - 53	Abandoned by ENSR
MW-10	5 - 60	Abandoned by ENSR
MW-11	15 - 30	Maintained by Avery Dennison
MW-12S	4 - 14	New Installation by ENSR
MW-12D	45 – 55	New Installation by ENSR

ENSR abandoned existing wells MW-1, MW-2, MW-4, MW-9 and MW-10. The wells were abandoned by Advanced Drilling in accordance with PADEP guidance dated February 29, 1996. The monitoring wells were abandoned in place by completely filling the wells with sealant (bentonite grout). The sealant was introduced using a tremie-grout procedure from the bottom of the well. The flush-mounted protective covers were removed and the area of the well was covered with concrete before backfilling to grade.

Monitoring well MW-11 appears to be constructed in accordance with PADEP guidance. Although we are not proposing to sample this well, ENSR recommended that Avery Dennison maintain this well for possible future sampling. Recovery well RW-1 remains open to a depth of 113 feet. As discussed in Section 6 below, Avery Dennison proposes to collect confirmation samples from RW-1 and MW-11 for VOCs and SVOCs, along with the newly installed and retrofitted wells. Should the results confirm that

groundwater quality is still below applicable Statewide Health Standards, Avery Dennison will notify PADEP of its intent to properly abandon site wells.

4.3.6 Monitoring Well Sampling

There were three objectives to the groundwater sampling program: (1) to meet the substantive analytical requirements set forth under Act 2 for assessment monitoring; (2) to obtain the necessary geochemical data to assist in the evaluation of natural attenuation as the preferred remedy; and (3) to obtain the necessary field parameters to assist in the construction of a three-dimensional groundwater fate and transport model, if necessary.

According to PADEP, groundwater samples are to be analyzed for VOCs and SVOCs when No. 4 oil is a potential contaminant of concern. The analytical methods specified by PADEP are EPA Method 8260B for VOCs, and EPA Method 8270C for SVOCs.

The groundwater sampling program for the Quakertown site included ten monitoring wells. Each monitoring well was analyzed for VOCs, SVOCs, pH, dissolved oxygen, nitrate, ferrous iron, sulfate, and methane.

To properly document intrinsic biodegradation at the Quakertown site, it was necessary to include an assessment of the electron acceptors and donors found in the groundwater. Common electron acceptors found in groundwater contaminated with BTEX compounds include dissolved oxygen, nitrate, ferrous iron, sulfate, methane, and carbon dioxide. Microorganisms utilize these electron acceptors in the metabolization of hydrocarbons (electron donors). Depending on the types of electron acceptors and donors present, biodegradation may occur by aerobic respiration, denitrification, iron reduction, sulfate reduction, or methanogenesis.

To the extent possible, the monitoring wells were purged and sampled proceeding from the suspected least to most contaminated wells to minimize the potential for cross contamination. The sampling order of the wells from the least to most contaminated was based on the depth of screened interval, groundwater flow directions, well location with respect to the suspected source areas, historical monitoring data, and field PID readings on drill cuttings. The deeper wells were sampled prior to the shallow wells.

Well purging was completed to obtain representative samples of water flowing through the aquifer. The volume of water required to be evacuated from monitoring wells is often set by regulatory agencies at an arbitrary three to five well volumes of water standing in the well. While this is a good rule of thumb for many situations, ENSR relied on geochemistry to establish well stabilization and adequacy of well purging. Approximately two to three well casings were evacuated by ENSR prior to sampling.

Water quality indicator parameters were used to determine purging needs prior to sample collection in each well. Stabilization of pH, specific conductance, dissolved oxygen, redox, temperature and turbidity were used to determine when formation water is accessed during purging. Three successive readings will be within 3% for conductivity, 10 mV for redox potential, and 10% for turbidity and dissolved oxygen. Prior to sampling, all sampling device and monitoring equipment will be calibrated according to the manufactures recommendations. Calibration of the pH meter will be performed with at least two buffers which bracket the expected pH range. Dissolved oxygen calibration will be calibrated to correct for temperature, local barometric pressure, and elevation.

Upon field parameter stabilization, sampling was initiated. Samples for VOCs were collected first and directly into pre-preserved sample vials. Upon collection of the VOC samples the remaining sample containers were filled. Dissolved oxygen data were obtained using a flow-through cell apparatus provided by YSI, Inc. This flow-through cell apparatus is used by ENSR on a case-specific basis, when *in-situ* dissolved oxygen values are needed to evaluate natural attenuation viability. Each sample vial was filled completely, without air bubbles introduced, by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

Management of sample purge water was in accordance with Avery Dennison requirements and PADEP's guidance. The purge and sample pump were decontaminated by pumping decontamination solutions through the pump to ensure that any sediment trapped in the pump was removed. The pump exterior and electrical wires were decontaminated as well. The equipment was flushed with potable water, with a detergent rinse, and included a flush with distilled/deionized water.

All sample bottles were provided by Lancaster Laboratories of Lancaster, Pennsylvania. Lancaster Laboratories is a Pennsylvania-certified laboratory.

4.3.7 Synoptic Water Level Surveys

Prior to initiating any sampling activities, a complete round of synoptic water levels were obtained from each existing and newly installed well. Measurements were initially collected using an optical-interface probe to screen for the presence of light non-aqueous phase liquids (LNAPL). Prior to collecting the water levels, each well was also screened with a PID for the presence of organic vapors in the well. The water levels were recorded to the nearest one-hundredth foot. A supplemental round of synoptic water level measurements were obtained on July 22, 1999. Table 4-2 provides the synoptic water level measurements obtained during the investigation.

4.4 Quality Assurance/Quality Control

All aspects of the Quakertown field program were controlled through adherence to written Standard Operating Procedures.

ENSR maintained a rigorous quality assurance/quality control (QA/QC) program during the project that incorporated the following mechanisms: planning, assessment, and correction. The QA/QC program for the Avery Dennison field investigation focused on the following four key elements:

- Preparation of field sampling plans that document sampling protocols and communicate objectives and procedures to the individuals implementing the work;
- Collection and analysis of field QC samples such as blanks, spikes, and duplicates that allow the quality of data to be evaluated;
- Validation of analytical and field data to ensure that the data produced is defensible and of known and acceptable quality; and
- Review of ENSR's final work product for technical soundness and accuracy and completeness of presentation.

4.4.1 Data Validation

One duplicate, one matrix spike/matrix spike duplicate (MS/MSD) sample, two field blanks, and one trip blank were collected during the groundwater sampling program. For the soil sampling program (off-site sample analysis), one duplicate, one MS/MSD sample, one field blank, and one trip blank were collected.

Although this project was completed in accordance with PADEP Act 2, ENSR validated all laboratory data in accordance with accepted EPA Region III requirements and validation guidance documents (Region III Modifications to National Functional Guidelines for Organic Data Review). These guidelines, which were designed for Contract Laboratory Program (CLP) data, have been modified by ENSR for use with non-CLP methods (for example SW-846). Validation covered 100 percent of the data and all elements of the Region III guidance, an approach that is necessary because of the confidence level needed for the end use of the data (i.e. risk-based analysis). Once validated, data qualifiers stipulated by Region III were applied to the data if necessary. Validation reports, documenting the validation results, were prepared using the Region III format as guidance. Copies of the independent data validation are provided in Appendix E.

4.4.2 Field Sampling Program Quality Assurance

Drilling equipment was decontaminated prior to initial use, between boring locations, and the completion of drilling activities. This decontamination (steam cleaning) was undertaken in a designated decontamination area designed to contain rinse water from the decontamination process. The decontamination water was containerized (at the request of Avery) for possible off-site disposal. All sample equipment (submersible pumps, water level indicator, were decontaminated according to PADEP guidance. All decontamination water was discharged to the Quakertown POTW.

All instruments used during the groundwater sampling events were calibrated according to PADEP guidance. Calibration of the pH meter will be performed on a daily basis with at least two buffers which bracket the expected pH range. Dissolved oxygen and redox meters were calibrated daily and corrected for temperature and local barometric pressure. Specific conductance meters were calibrated daily against a KCl solution.

Calibration checks of the field Gas Chromatograph (GC) were performed at a minimum of twice daily. The GC will be initially calibrated at levels representing concentrations of 0.10, 0.050 and 0.025 mg/Kg for all compounds of interest. A 0.050 mg/Kg standard was analyzed after every 15 injections into the GC instrument. The response factor determined for this continuing calibration standard was compared to the average response factor from the initial calibration standards to determine consistency in instrument response for all compounds of interest.

A single point calibration was conducted prior to any field activities using site-specific standards. If a calibration check fell outside the manufacturers suggested range, a complete multi-port calibration was performed. A baseline scan utilizing deionized water was run each day prior to analyzing any site samples.

An instrument log for the field GC was maintained by the ENSR chemist. This log included instrument maintenance, blank, and calibration information, including date, time, analyst's name, calibration compounds, calibration compound concentrations, and calibration compound readings in area units.

Field logs documented the sample identification number, date, time, location, depth, soil type, sample media, soil moisture, and analytical result.

5 ANALYTICAL RESULTS

The following section provides a summary of the analytical results obtained during the supplemental investigation at the Quakertown Facility.

5.1 Soil Quality by Field Gas Chromatograph

Figure 5-1, provides an illustration of the grid sampling program and soil boring locations evaluated by ENSR using field GC screening techniques. The results for the samples submitted to the off-site laboratory for confirmation are also included on this figure. Included in Table 5-1 are the results of the field screening analyses completed by ENSR using an on-site gas chromatograph (GC). Appendix F includes a summary of the analytical methods employed during the field screening, including the results of the quality assurance and quality control (QA/QC) samples analyzed by the ENSR chemist during the screening. As shown in Table 5-1, all of the analytical results were less than the method detection limit established for the screening level assessment. As previously discussed in Section 4, the field GC was used by ENSR as a streamlined screening tool to determine which samples would be submitted to the laboratory for confirmation sampling.

5.2 Soil Quality by Off-Site Laboratory Methods

The analytical results for the confirmation soil samples submitted to Lancaster Laboratories, Inc. are summarized in Table 5-2, and the analytical data sheets provided by the laboratory are included in Appendix G. As discussed below, all soil quality data were below PADEP's Statewide Health Standards. Therefore, no further action is warranted.

5.3 Groundwater Quality

Table 5-3 presents the results of the laboratory analytical data for the groundwater sampling event completed on March 22 and 23, 1999 at the Quakertown Facility, and Appendix H includes the laboratory data sheets provided by Lancaster Laboratories. Table 5-3 also includes the analytical results of inorganic constituents that were included in the field sampling program to assist in the evaluation of biological natural degradation in the subsurface, if constituents of concern were found.

Each well was sampled for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). ENSR also sampled the wells for pH, dissolved oxygen, nitrate, ferrous iron, sulfate, and methane for potential use in the evaluation of natural attenuation as the preferred remedy, if necessary. VOCs were not detected in any monitoring well.

With respect to the SVOCs, two constituents were detected; fluorene and bis (2-ethylhexyl)phthalate. Fluorene was detected in monitoring well MW-5D at an estimated concentration of 3 μg/L. However, this concentration is well below the Statewide Health Standard MSC of 190 μg/L for aquifers that are

designated suitable for drinking water purposes. The result was considered to be an estimated value (qualified) because fluorene was detected below the laboratory practical quantitation limit of 5 µg/L.

Bis (2-ethylhexyl) phthalate was detected slightly above the Statewide MSC of 6 µg/L in all five of the newly-installed deep monitoring wells. This phthalate ester, which is a common laboratory artifact, was not detected in the shallow monitoring wells, nor was it detected in the duplicate sample obtained from monitoring well MW-12D. The concentration of bis (2-ethylhexyl) phthalate in the deep monitoring wells ranged between 4 µg/L (MW-7D and MW-12D) to 14 µg/L (MW-8D).

Even though trace levels of bis (2-ethylhexyl) phthalate are sometimes associated with laboratory analytical instrumentation, this constituent was not detected in any blank analyzed by the laboratory. Therefore, without additional information to rule out laboratory contamination, the presence of bis (2-ethylhexyl) phthalate is assumed to exist at the concentrations reported by the laboratory. It is possible, however, that the occurrence of bis (2-ethylhexyl) phthalate may be related to the polyethylene tubing used by ENSR to purge the monitoring wells prior to sampling; but this possibility is not fully supported by the analytical data, since the shallow wells were also purged using polyethylene tubing. If polyethylene tubing was responsible, both the shallow and deep water samples would be expected to exhibit low levels of bis (2-ethylhexyl) phthalate. As discussed in Section 6 below, ENSR recommends that a confirmation round of sampling be conducted for the 10 monitoring wells at the site (using Teflon-lined purge tubing) prior to Avery Dennison seeking a formal release from liability for the Quakertown Facility. Our experience has shown that the Pennsylvania Department of Environmental Protection typically requires two rounds of sampling data before such a release is granted.

Where health-based criteria in drinking water exist for the inorganic constituents (i.e. sulfate, nitrite-nitrogen, nitrate-nitrogen), the results were reported by the laboratory were less than any action level. The inorganic water quality data was primarily evaluated by ENSR to document conditions favorable for biological activity, should the analytical results have identified the presence of constituents of concern.

Dissolved oxygen levels were consistently higher in the shallow hydrologic zone compared to the deeper hydrologic zone monitoring wells. The oxygen levels in both zones, however, indicate that aerobic conditions are present in the subsurface, which is favorable for aerobic biological degradation.

Sulfate concentrations were reviewed to assess whether sulfate reduction was a potential microbial degradation pathway. Sulfate concentrations were within regional background levels for the Brunswick Shale Lithofacies, but the concentration was generally higher in the deeper wells compared to the shallow wells. Since each milligram per liter of sulfate consumed by microbes results in the destruction of approximately 0.21 mg/L of BTEX, a pattern of sulfate depletion is often observed in groundwater quality data. A pattern of sulfate depletion appears to be represented in monitoring well couplets 5 and 6, when compared with the other couplets.

Methane, a common microbial respiration by-product, was detected in MW-7D (140 µg/L) and MW-12D (480 µg/L). Although these levels are relatively low, its presence in the groundwater suggests that microbial activity does exist in the subsurface, and biological degradation most likely contributed to the success of the groundwater remediation program completed at the site in the early 1990's. The microbial degradation of 1 mg/L of BTEX results in the production of approximately 0.78 mg/L of methane during methanogenesis. The presence of 480 µg/L of methane in the former source area is consistent with a microbial origin.

5.4 Laboratory Quality Assurance and Quality Control

The quality of the analytical data generated for this program was evaluated during data validation by assessing conformance to stipulated methodologies, adherence to sample holding times, field and laboratory QC samples and performance checks, and completeness. Data were reviewed using U.S. EPA Region III data validation protocols. The results of validation indicated that the quality of the data was acceptable and adequate to meet the objectives of the program. In general, the analyses performed conformed to the requested methodologies. All samples, with the exception of two soil samples, B-4(9.5-10.0) and B-1(7.6-8.0) analyzed for VOCs, were analyzed within method-required holding times. The results for these two samples were qualified as estimated.

Overall, the results of field and laboratory QC samples and performance checks indicated adherence to established sampling and analytical procedures. No target analytes were detected in the method blanks, equipment blanks, or trip blanks. The analyses of spiked samples (including site-specific MS/MSDs and laboratory control samples), and other performance checks designed to measure accuracy, indicated that the methods used were appropriate and that the data were accurate. Precision of field and analytical systems, as measured by field duplicates and MS/MSD samples, were within established criteria, indicating acceptable reproducibility of measurements.

A limited number of soil data points required qualification because of nonconformance with calibration criteria. In the VOC analyses, acetone results in all samples (all non-detects) were rejected (i.e., deemed unusable). In the field blank associated with the soil analyses, the non-detected result for benzo(b)fluoranthene was qualified as estimated.

Data completeness for the program was calculated by comparing the number of valid data points (i.e., those considered acceptable according to validation criteria) to the total number of data points. Valid data was achieved for more than 99% of that measured.

5.5 Attainment of Statewide Health Standards for VOCs and SVOCs

As shown in Table 5-2, all soil sample results were reported by the laboratory to be less than the Medium-Specific Statewide Health Standards for all Target Compound List Volatile Organic Compounds (TCL VOCs) and Target Compound List Semivolatile Organic Compounds (TCL SVOCs). Therefore, Avery Dennison has satisfied the criteria to obtain a Release from Liability under Act 2 for

future cleanup obligations in soil. No further action is warranted for soils in the former UST and former above ground solvent recovery unit in the southeast corner of the property.

As shown in Table 5-3, all TCL VOCs were detected below the laboratory quantitation levels in every groundwater sample. The quantitation levels reported by the laboratory were all less than the Medium-Specific Concentrations (MSCs) for regulated VOCs in groundwater for aquifers used for drinking water purposes. Therefore, Avery Dennison has satisfied the criteria to obtain a Release From Liability under Act 2 for future cleanup obligations in groundwater for VOCs.

With the exception of trace levels of bis (2-ethylhexyl) phthalate that were detected in the deep bedrock monitoring wells, all TCL SVOCs were detected below the Medium-Specific Concentrations (MSCs) for regulated SVOCs in groundwater for aquifers used for drinking water purposes. Bis (2-ethylhexyl) phthalate was detected slightly above the Statewide Health Standard MSC of 6 μg/L in all five of the newly-installed deep retrofitted monitoring wells. This phthalate ester, which is a common laboratory artifact, however was not netected in the shallow monitoring wells, nor was it detected in the duplicate sample obtained from monitoring well MW-12D. ENSR believes that the low levels of bis (2-ethylhexyl) phthalate may be an artifact related to laboratory or field sampling methods, as phthalate esters were not detected in the blind duplicate sample submitted to the laboratory, nor were phthalate esters used by the facility. Avery Dennsion will conclude this fact with an additional round of well sampling using a more stringent sampling protocol.

All inorganic constituents for which a Statewide Health Standard exists (i.e. sulfate, nitrite-nitrogen, and nitrate-nitrogen) were below Pennsylvania's MSCs for drinking water. Because the inorganic parameters were all below action levels, and were included in the sampling program by ENSR to assist in evaluating biological degradation, no additional confirmation sampling is recommended for these constituents.

6 CONCLUSIONS AND RECOMMENDATIONS

The supplemental site investigation was conducted on behalf of Avery Dennison to address potential residual soil and groundwater contamination associated with their former solvent recovery unit and former underground tank systems near the southeast corner of the property.

All soil samples analyzed during the course of the investigation were below Pennsylvania's Statewide Health Standards. Therefore, no further action is proposed for the soils in the vicinity of the former solvent recovery and underground tank systems near the southeast corner of the property.

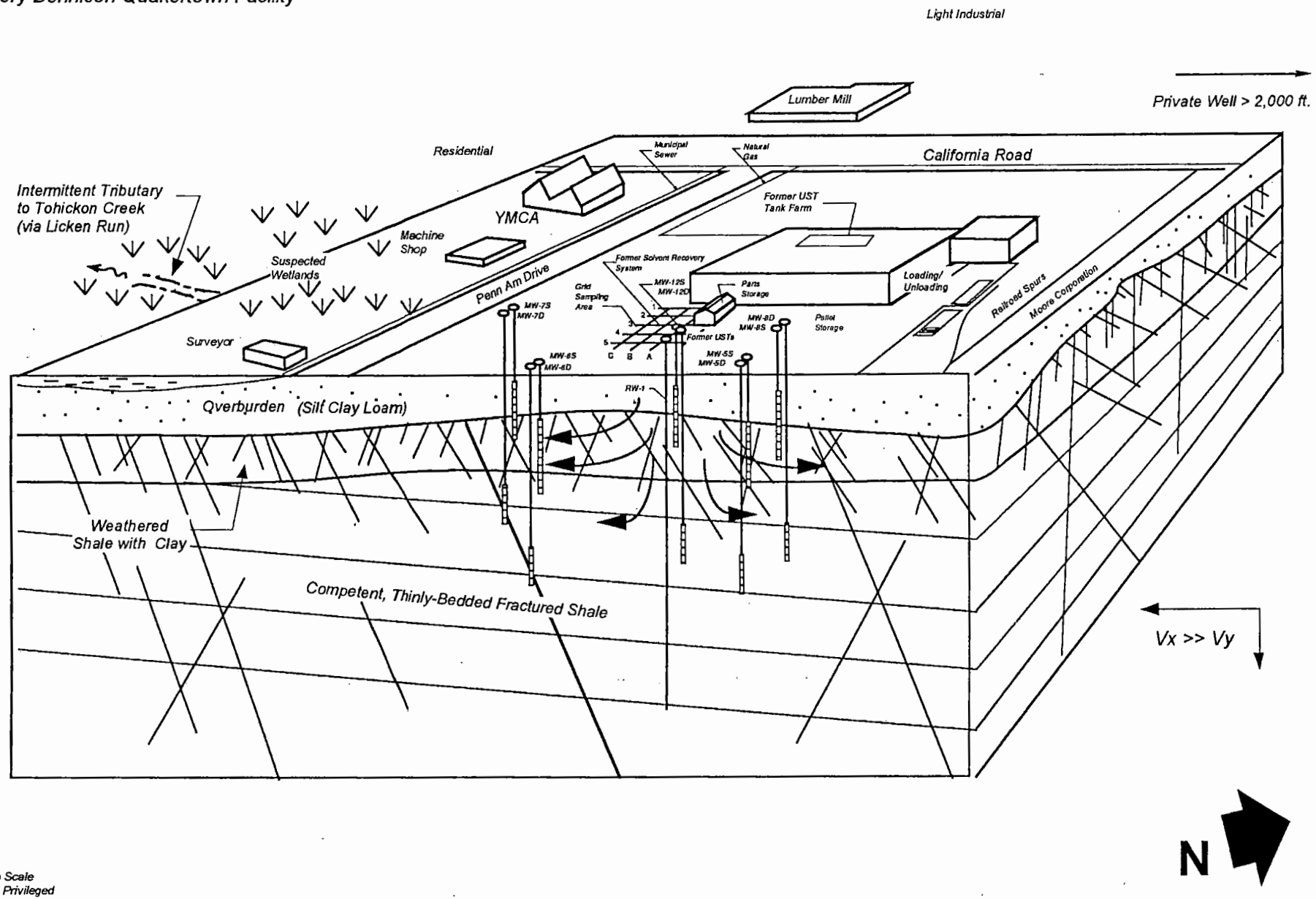
With the exception of trace levels of bis (2-ethylhexyl)phthalate, which was detected in on-site groundwater slightly above the Statewide Health Standards, all groundwater constituents are below regulatory action levels. ENSR believes that the low levels of bis (2-ethylhexyl) phthalate may be an artifact related to laboratory or field sampling methods. ENSR will be able to conclude this fact with an additional round of well sampling using a more stringent sampling protocol.

Prior to formally submitting the necessary paperwork to attain a release from liability for future cleanup obligations in the areas investigated, ENSR recommends that a confirmation round of groundwater sampling be conducted for VOCs and SVOCs. ENSR also proposes to include existing monitoring well MW-11 and former recovery well RW-1 in the sampling program. ENSR will utilize Teflon-lined tubing during this proposed sampling event to determine whether the presence of bis (2-ethylhexyl) phthalate was a result of using polyethylene tubing during well purging prior to sampling. Should the confirmation sampling again show the presence of bis (2-ethylhexyl) phthalate, Avery Dennison may still be eligible to obtain a release from liability using the Site-Specific Standard approach afforded under Act 2. Should the results confirm that groundwater quality meets Pennsylvania's Statewide Health Standards, a proposal to properly abandon the wells at the site will be recommended.

7 REFERENCES

Willard, 1959, Geology and Mineral Resources of Bucks County, Bull. C29

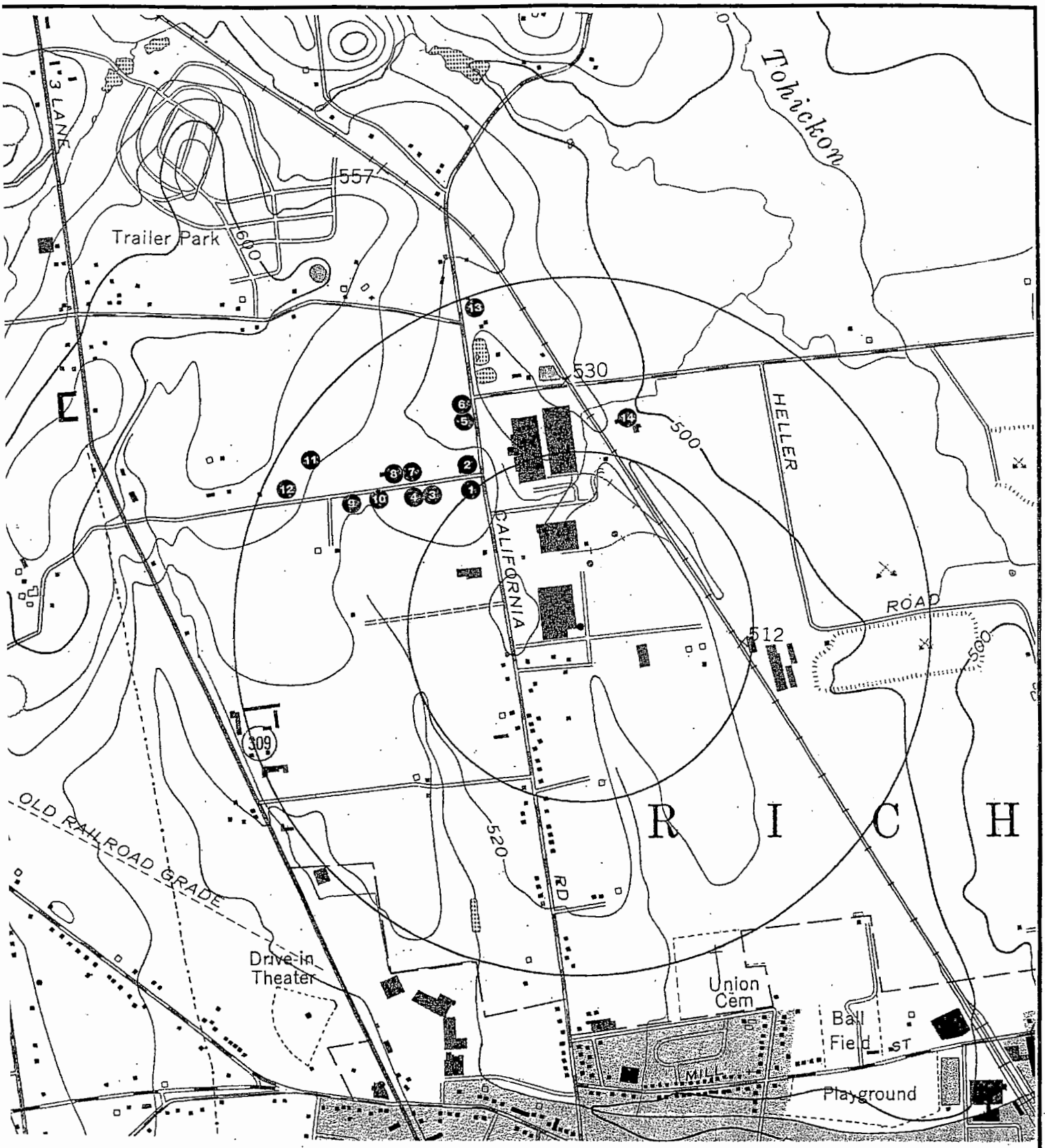
Figure 2-2
Revised Conceptual Model of Site Conditions
Avery Dennison Quakertown Facility



Not to Scale
Client Privileged

Vertical Exaggeration is approximately 5X.

RFC 5-99



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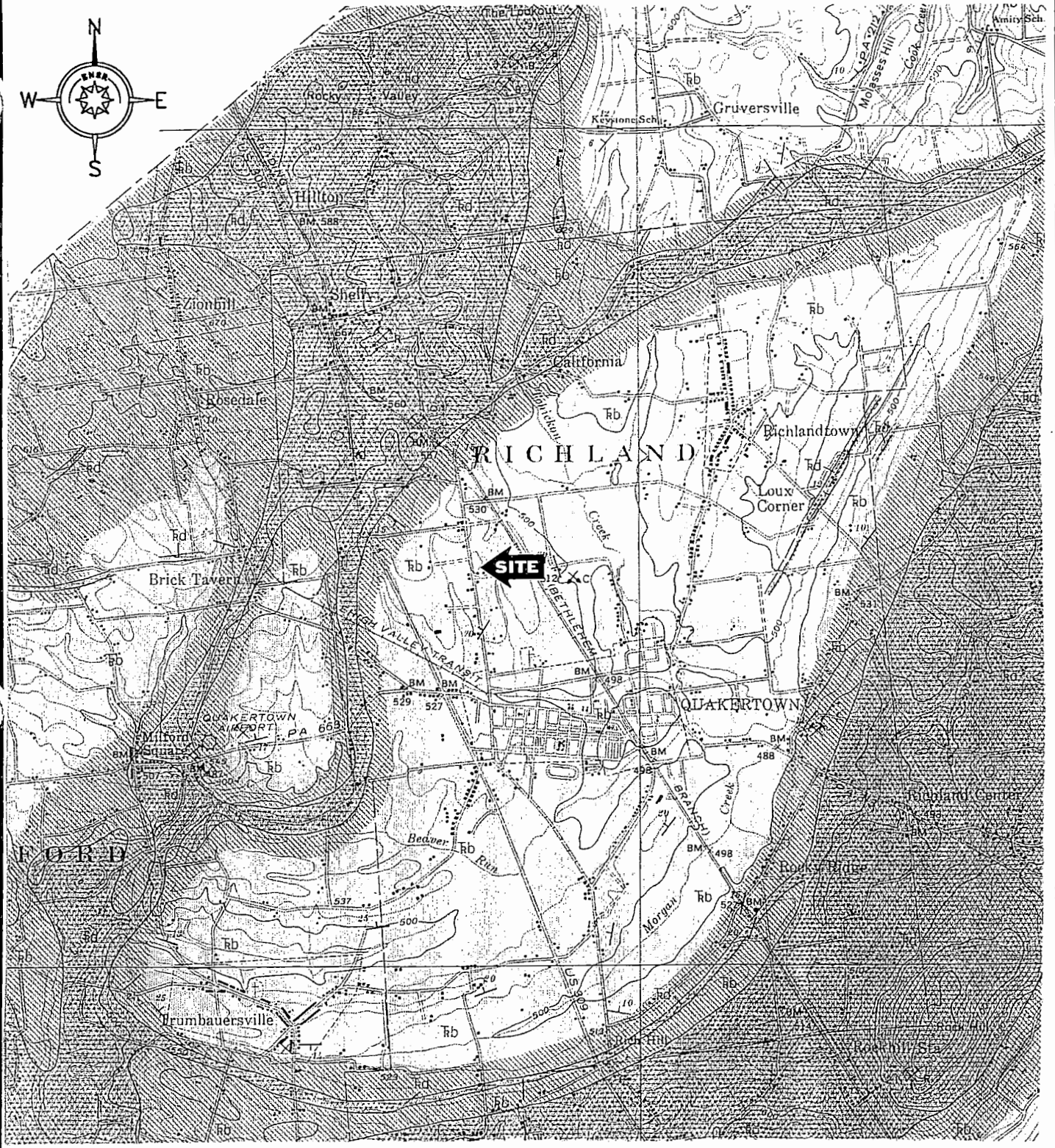
POTABLE WELL LOCATION WITHIN
ONE-HALF MILE OF THE SITE

AVERY DENNISON
QUAKERTOWN, PENNSYLVANIA

DRAWN:	DATE:	FIGURE NUMBER
JNM	6/11/99	3-1
SCALE:	PROJECT NUMBER	DRAWING NUMBER



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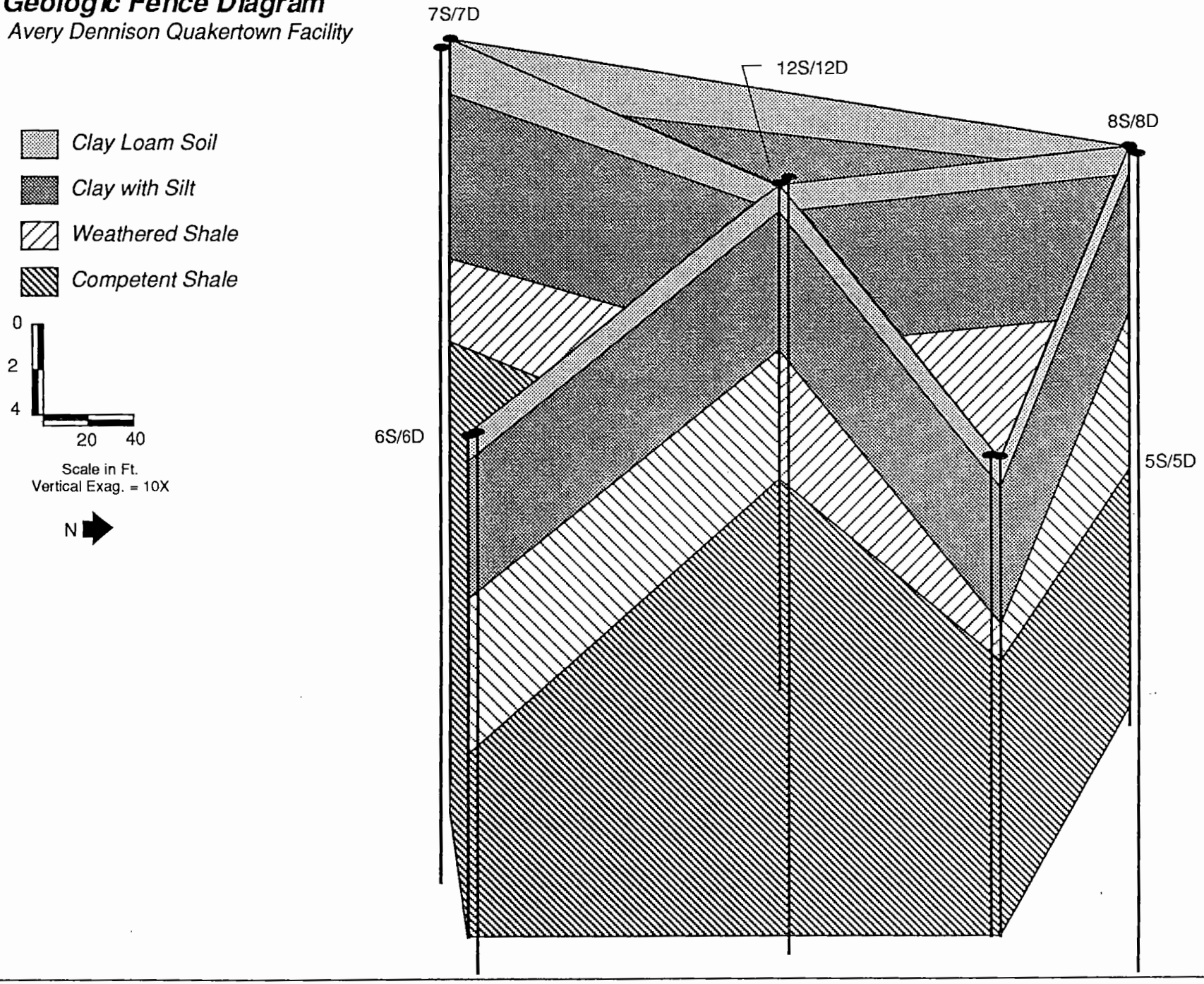
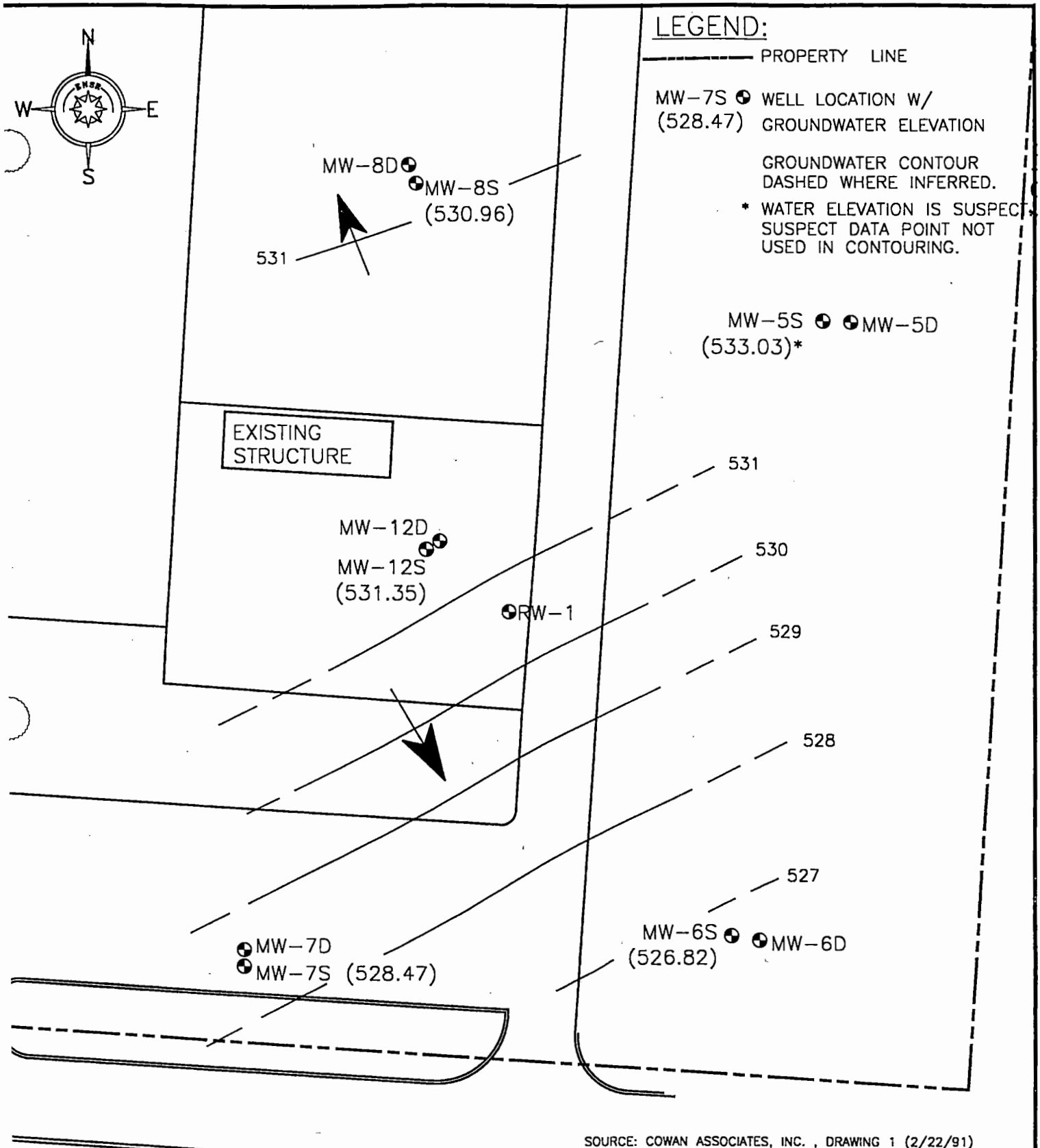
SITE GEOLOGIC MAP

AVERY DENNISON
QUAKERTOWN, PENNSYLVANIA

DRAWN:	DATE:	FIGURE NUMBER
JNM	5/12/99	3-2
SCALE: 1" = 2,000'	PROJECT NUMBER 2246-021-013	DRAWING NUMBER GEOLOGIC.DWG

Figure 3-3
Geologic Fence Diagram
Avery Dennison Quakertown Facility





SOURCE: COWAN ASSOCIATES, INC. , DRAWING 1 (2/22/91)

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GROUNDWATER ELEVATIONS AND FLOW DIRECTION– SHALLOW WELLS, 3/22/99

AVERY DENNISON
QUAKERTOWN, PENNSYLVANIA

DRAWN:	DATE:	FIGURE NUMBER
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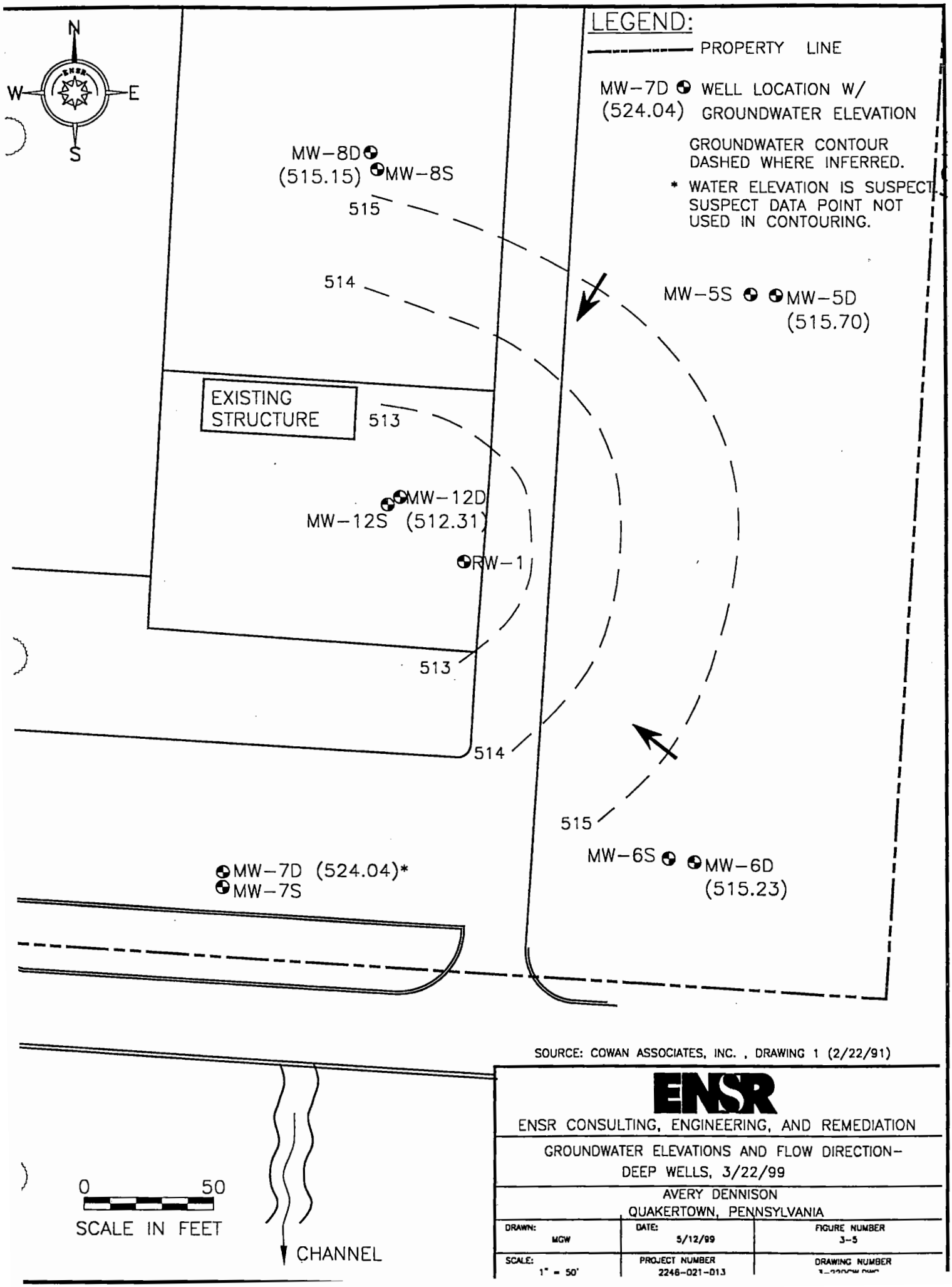

SOURCE: COWAN ASSOCIATES, INC. , DRAWING 1 (2/22/91)

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ENSR CONSULTING, ENGINEERING, AND REMEDIATION

GROUNDWATER ELEVATIONS AND FLOW DIRECTION–
DEEP WELLS, 3/22/99

AVERY DENNISON
QUAKERTOWN, PENNSYLVANIA

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MGW	5/12/99	3-5
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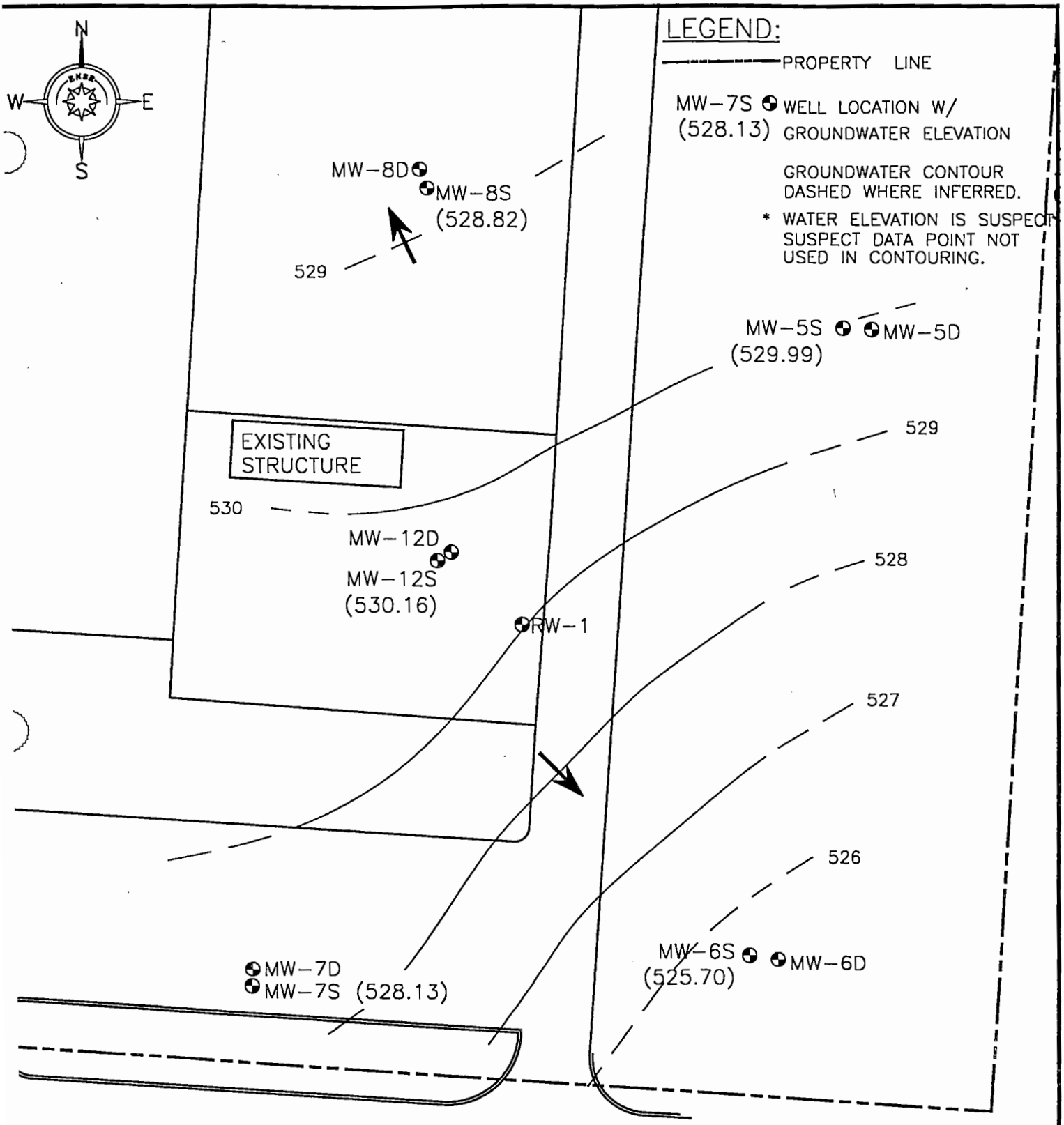

SOURCE: COWAN ASSOCIATES, INC. , DRAWING 1 (2/22/91)

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ENSR CONSULTING, ENGINEERING, AND REMEDIATION

GROUNDWATER ELEVATIONS AND FLOW DIRECTION– SHALLOW WELLS, 4/15/99

AVERY DENNISON
QUAKERTOWN, PENNSYLVANIA

DRAWN:	DATE:	FIGURE NUMBER
MGW	5/12/99	3-6
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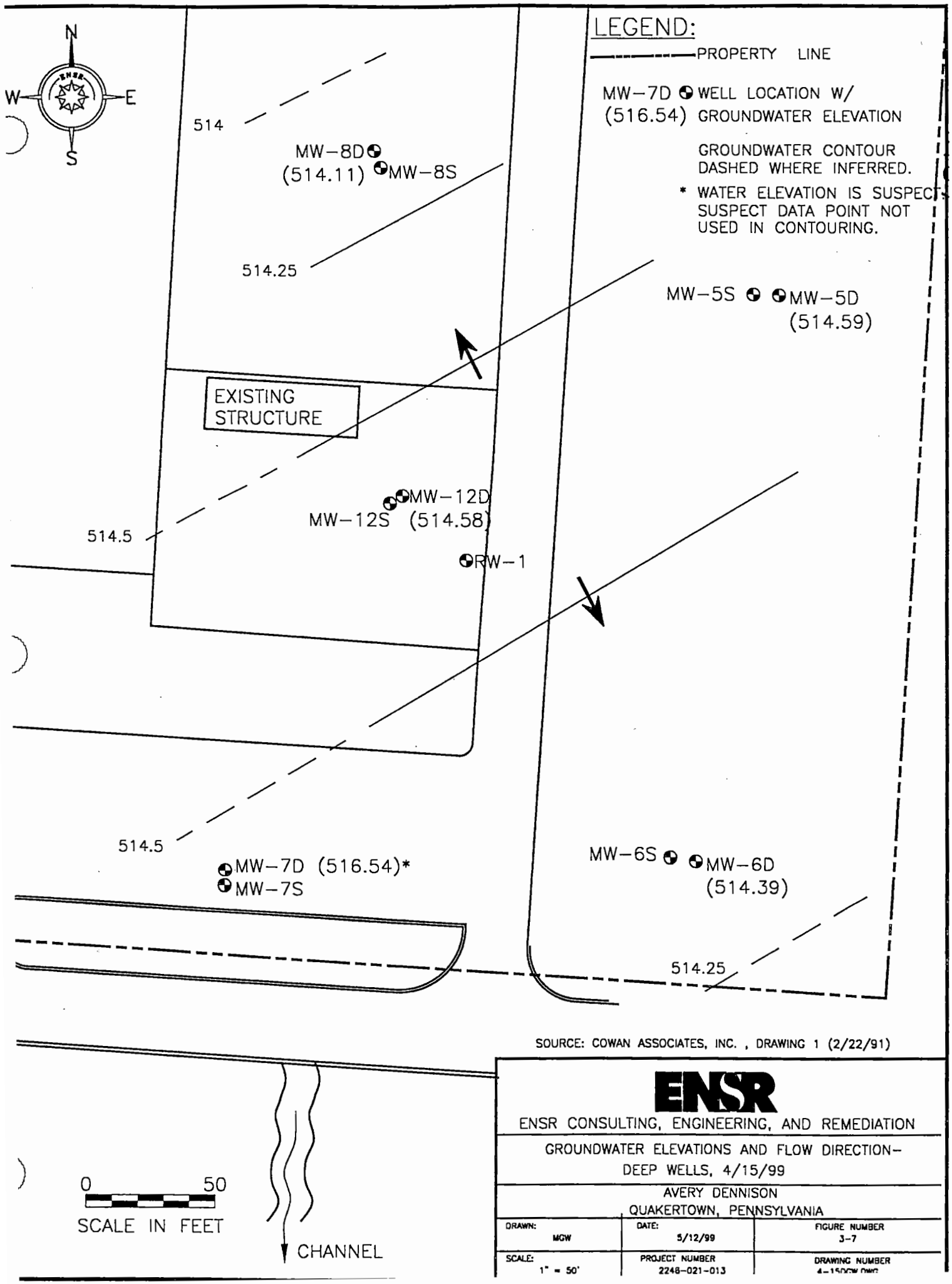

SOURCE: COWAN ASSOCIATES, INC. , DRAWING 1 (2/22/91)

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GROUNDWATER ELEVATIONS AND FLOW DIRECTION–
DEEP WELLS, 4/15/99

AVERY DENNISON
QUAKERTOWN, PENNSYLVANIA

DRAWN:	DATE:	FIGURE NUMBER
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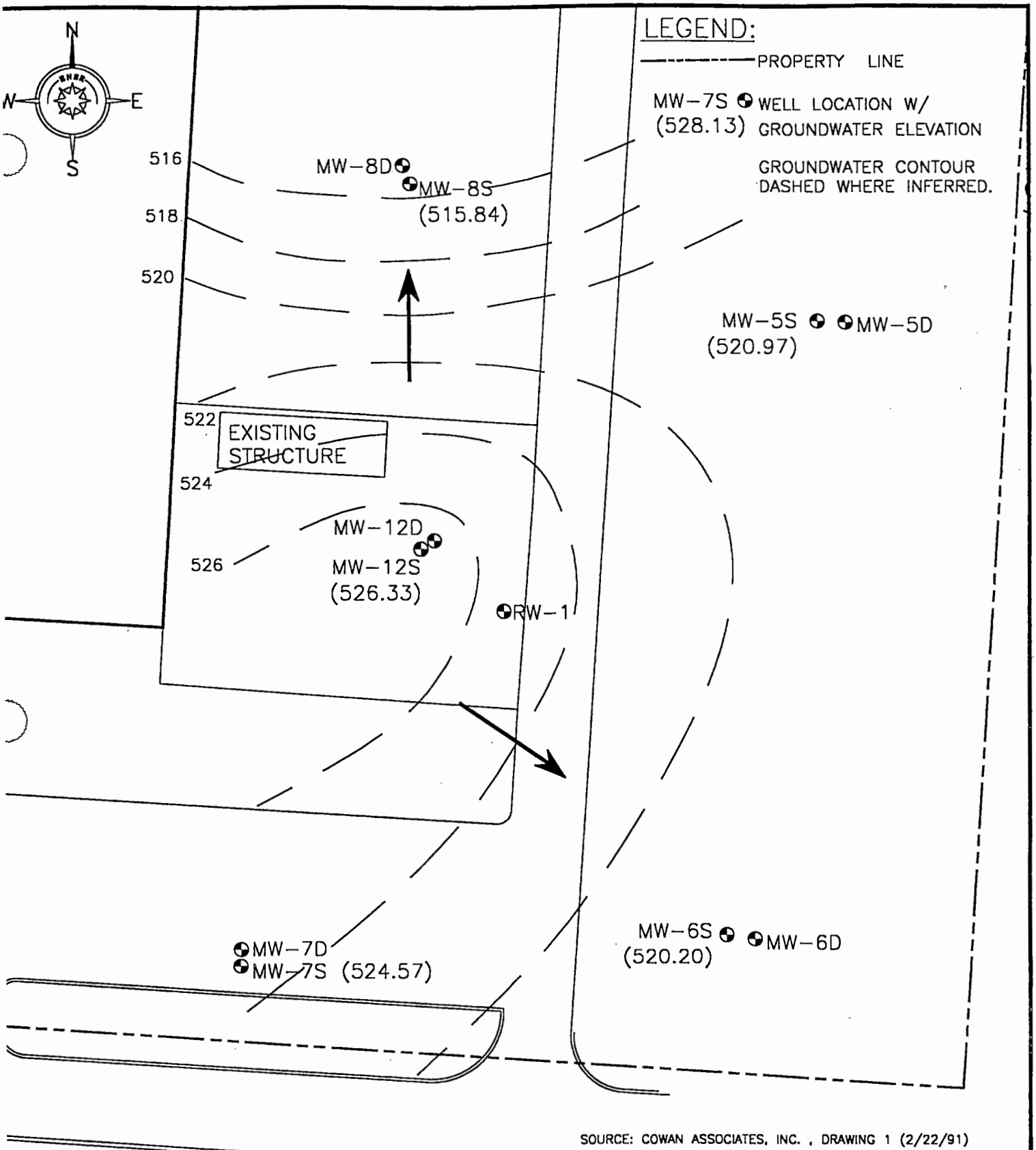

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ENSR CONSULTING, ENGINEERING, AND REMEDIATION

GROUNDWATER ELEVATIONS AND FLOW DIRECTION– SHALLOW WELLS, 7/22/99

AVERY DENNISON
QUAKERTOWN, PENNSYLVANIA

DRAWN:	DATE:	FIGURE NUMBER
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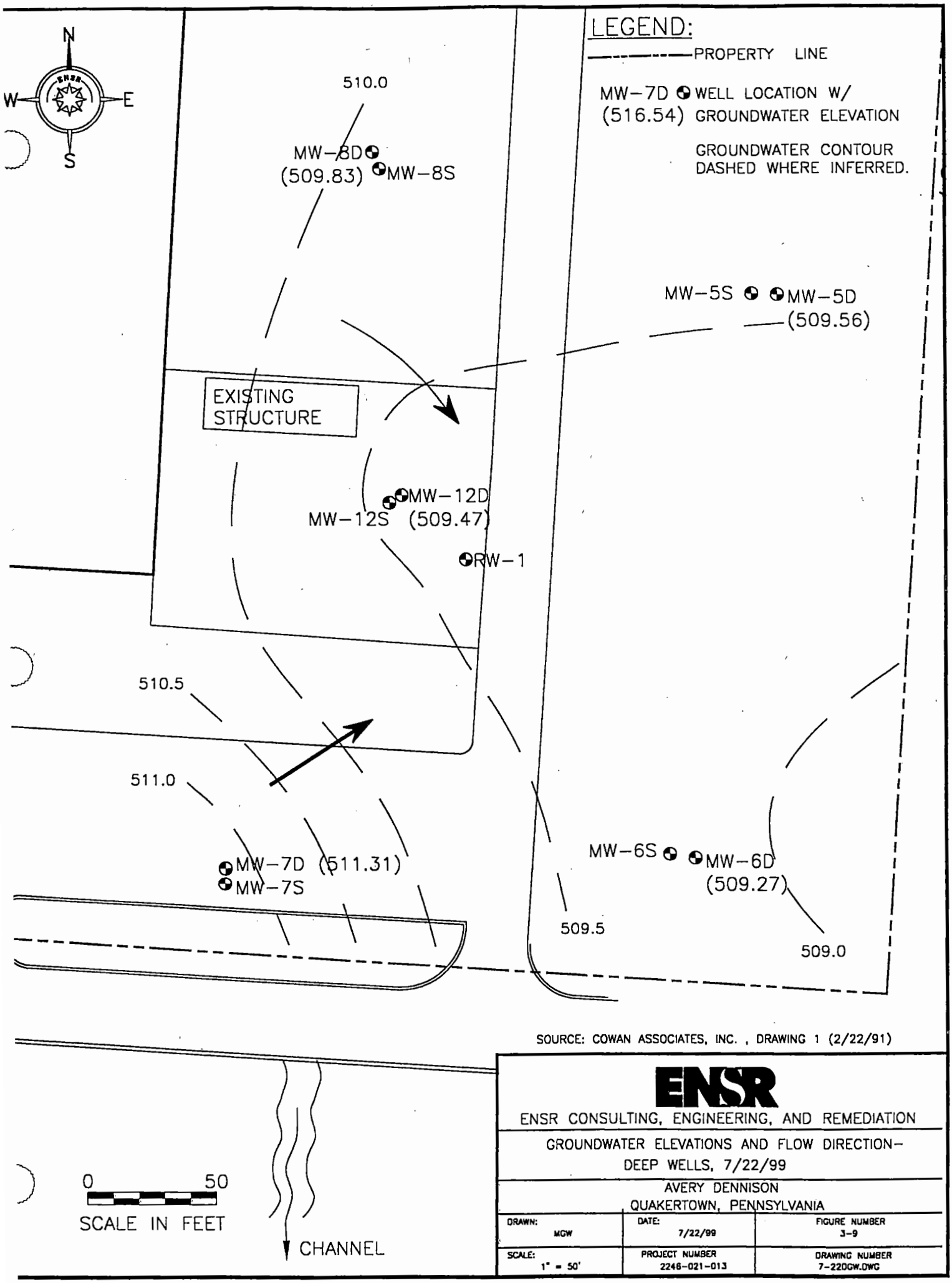

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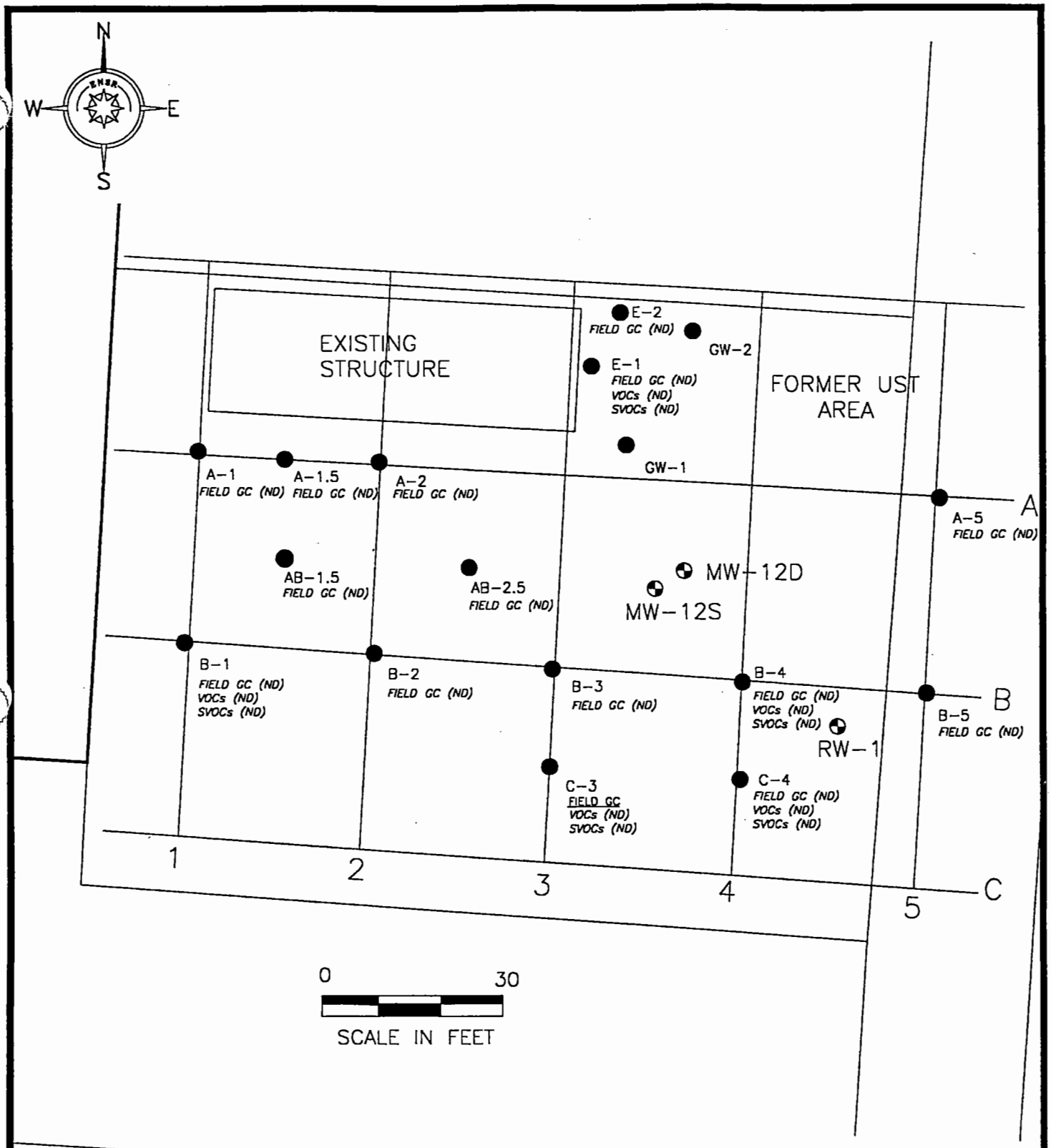
ENSR CONSULTING, ENGINEERING, AND REMEDIATION

GROUNDWATER ELEVATIONS AND FLOW DIRECTION–
DEEP WELLS, 7/22/99

AVERY DENNISON
QUAKERTOWN, PENNSYLVANIA

DRAWN:	DATE:	FIGURE NUMBER
MGW	7/22/99	3-9
SCALE: 1" = 50'	PROJECT NUMBER 2246-021-013	DRAWING NUMBER 7-220GW.DWG



LEGEND:

PROPERTY LINE

MW-7S WELL LOCATION

A-5 SOIL BORING LOCATION

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ENSR CONSULTING, ENGINEERING, AND REMEDIATION

SOIL BORING LOCATIONS AND RESULTS

AVERY DENNISON
QUAKERTOWN, PENNSYLVANIA

DRAWN:	DATE:	FIGURE NUMBER
JNM	5/12/99	5-1
	PROJECT NUMBER 2245-021-013	DRAWING NUMBER SOILBORING.DWG

Table 4-2
Groundwater Elevation Data
Avery Dennison Quakertown Facility

Well No.	*Top of Casing Elevation (MSL) (feet)*	*March 22, 1999 Depth to Water (feet)*	*Elevation (MSL) (feet)*	*April 15, 1999 Depth to Water (feet)*	*Elevation (MSL) (feet)*	*July 22, 1999 Depth to Water (feet)*	*Elevation (MSL) (feet)*
MW-5S	533.88	0.85	533.03	3.89	529.99	12.91	520.97
MW-5D	533.9	18.20	515.70	19.31	514.59	24.34	509.56
MW-6S	533.04	6.22	526.82	7.34	525.70	12.84	520.20
MW-6D	533.04	17.81	515.23	18.65	514.39	23.77	509.27
MW-7S	533.38	4.91	528.47	5.25	528.13	8.81	524.57
MW-7D	533.31	9.27	524.04	16.77	516.54	22.00	511.31
MW-8S	535.19	4.23	530.96	6.37	528.82	19.35	515.84
MW-8D	534.79	19.64	515.15	20.68	514.11	24.96	509.83
MW-12S	534.71	3.36	531.35	4.55	530.16	8.38	526.33
MW-12D	534.45	22.14	512.31	19.87	514.58	24.98	509.47

Table 5-1
Field GC Screening Analytical Results
Avery Dennison Quakertown Facility

Sample ID	A5	A5	A5	B5	B5	B5	B4
Depth	2.5 - 3.0	4.5 - 5.0	5.5 - 6.0	2.6 - 3.0	4.2-4.7	5.8 - 6.2	6.6 - 6.10
Sample Wgt (g)	4.63	3.86	4.82	3.47	3.65	4.01	3.58
Date Sampled	02/23/99	02/23/99	02/23/99	02/23/99	02/23/99	02/23/99	02/23/99
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Toluene	8.5 U	10 U	8.2 U	11 U	11 U	9.9 U	11 U

Sample ID	B4	B4	B3	B3	B3	B2	B2
Depth	7.5 - 8.0	9.5 - 10	6.0 - 6.5	7.5 - 8.0	9.5 - 10	5.0 - 5.5	8.0 - 8.5
Sample Wgt (g)	4.08	4.07	4.21	4.56	3.72	3.97	3.99
Date Sampled	02/23/99	02/23/99	02/23/99	02/23/99	02/23/99	02/23/99	02/23/99
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Toluene	9.9 U	9.7 U	9.4 U	8.7 U	11 U	9.9 U	9.9 U

Sample ID	B2	B1	B1	B1	A1	A1	A1
Depth	9.5 - 10	5.5 - 6.0	7.5 - 8.0	9.2 - 9.8	5.5 - 6.0	8.0 - 8.5	9.5 - 10
Sample Wgt (g)	4.01	3.94	4.1	5.35	4.3	4.33	3.93
Date Sampled	02/23/99	02/23/99	02/23/99	02/23/99	02/24/99	02/24/99	02/24/99
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Toluene	9.9 U	10 U	9.6 U	7.4 U	10 U	9.1 U	9.2 U

Sample ID	A2	A2	A2	A1.5	A1.5	A1.5	AB1.5
Depth	6.0 - 6.5	7.5 - 8.0	9.5 - 10	6.0 - 6.5	7.5 - 8.0	9.5 - 10	5.5 - 6.0
Sample Wgt (g)	4.32	3.96	3.98	4.00	4.72	4.21	3.92
Date Sampled	02/24/99	02/24/99	02/24/99	02/24/99	02/24/99	02/24/99	02/24/99
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Toluene	9.1 U	10 U	9.9 U	9.9 U	8.4 U	9.4 U	10 U

Sample ID	AB1.5	AB1.5	AB2.5	AB2.5	AB2.5	E1	E1
Depth	7.5 - 8.0	8.5 - 9.0	6.0 - 6.5	7.5 - 8.0	8.5 - 9.0	7.5 - 8.0	6.0 - 6.5
Sample Wgt (g)	4.14	3.95	3.71	3.83	3.68	3.42	3.45
Date Sampled	02/24/99	02/24/99	02/24/99	02/24/99	02/24/99	02/24/99	02/24/99
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Toluene	9.5 U	10 U	11 U	10 U	11 U	12 U	11 U

Sample ID	E1	E2	E2	E2	C4	C4	C3
Depth	9.0 - 9.5	5.5 - 6.0	7.5 - 8.0	9.5 - 10	6.0 - 6.5	7.5 - 8.0	6.0 - 6.5
Sample Wgt (g)	4.00	3.69	3.88	4.12	4.44	3.95	4.58
Date Sampled	02/24/99	02/24/99	02/24/99	02/24/99	02/24/99	02/24/99	02/24/99
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Toluene	NA	11 U	10 U	NA	NA	10 U	NA

Sample ID	C3	C3
Depth	7.5 - 8.0	8.5 - 9.0
Sample Wgt (g)	3.17	3.83
Date Sampled	02/24/99	02/24/99
	mg/kg	mg/kg
Toluene	NA	10 U

U - undetected at the specified detection limit; NA - not analyzed
All results are reported on a wet weight basis.

Table 5-2
Soil Sample Confirmation Results (µg/L)
Avery Dennison Quakertown Facility

Sample Designation	***B-4***	***B-1***	***E-1***	***C-4***	***C-4D***	***FB-1***	***TB-1***
Depth (ft.)	***(9.5-10.0)***	***(7.6-8.0)***	***(6.0-6.5)***	***(7.5-8.0)***	***(Dupicate)***		
Date Collected	***2-23-99***	***2-23-99***	***2-24-99***	***2-24-99***	***2-24-99***	***2-24-99***	***2-24-99***
Time Collected	***1545***	***1555***	***1430***	***1440***	***1445***	***1515***	***1730***
TCL Volatile Organic Compounds	ND	ND	ND	ND	ND	ND	ND
TCL Semivolatile Organic Compounds	ND	ND	ND	ND	ND	ND	ND

Notes:
ND: not detected
All results were reported less than the practical quantiation limits, which were quantified by the laboratory to be less than the Medium-Specific Statewide Health Standards

Table 5-3
Ground Water Monitoring Results ($\mu g/L$)
Avery Dennison Quakertown Facility

Monitoring Well Designation	***Act 2***	***MW-5S***	***MW-5D***	***MW-6S***	***MS-6D***	***MW-7S***	***MW-7D***	***MW-8S***	***MW-8D***	***MW-12S***	***MW-12D***	***MW-12S-D***	***TB-1***	***FB-1***	***TB-2***	***FB-2***
Date Collected	***MSCs***	***3-22-99***	***3-22-99***	***3-23-99***	***3-23-99***	***3-23-99***	***3-23-99***	***3-22-99***	***3-22-99***	***3-23-99***	***3-23-99***	***3-23-99***	***3-22-99***	***3-22-99***	***3-23-99***	***3-23-99***
Time Collected	***Used Aquifers***	***1230***	***1200***	***1300***	***1000***	***1230***	***1215***	***1500***	***1430***	***1440***	***1420***	***1440***	***-***	***1550***	***-***	***1415***
Volatile Organic Compounds		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds		ND	ND	ND		ND		ND		ND		ND	NA	ND	NA	ND
fluorene	190		3 J													
bis (2-ethyl-hexyl)phthalate	6		5 J		11		4 J		14		4 J					
Inorganic Parameters													NA	NA	NA	NA
Sulfate	500	28.1	23.3	46.2	42.6	70.1	140	133	150	125	111	130		ND		ND
Nitrate-Nitrogen	10	0.57	1.39	0.72	0.95	ND	ND	ND	0.50 J	2.06	ND	1.91		ND		ND
Nitrite-Nitrogen	1	ND	ND	ND	ND	ND	ND	ND	ND	1.06	ND	0.97		ND		ND
Ferrous Iron		ND	ND	ND	ND	ND	ND	0.0917 J	0.0065 J	0.0104 J	ND	0.006		ND		ND
Methane		ND	ND	ND	ND	140	ND	3 J	2 J	480	6.5	380		ND		ND
Dissolved Oxygen		9.68	0.2	4.56	0.23	1.68	0.19	3.88	0.6	0.12	0.75	0.12		-		-
Temperature (C)		7.5	12.7	13	12	14.5	16	11.5	15	10.6	17.3	10.6		-		-
pH (S.U.)		6.98	7.57	6.95	7.29	6.27	7.13	7.00	6.95	7.12	7.44	7.12		-		-

Sulfate, Nitrate-Nitrogen, Nitrite-Nitrogen, Ferrous Iron, and Dissolved Oxygen results are reported in mg/L. All other results, including methane are reported in µg/L.
ND: not detected
NA: not analyzed
J: compounds was detected below practical quantitation limit and is considered an estimate.

APPENDIX A
AERIAL PHOTOGRAPHS

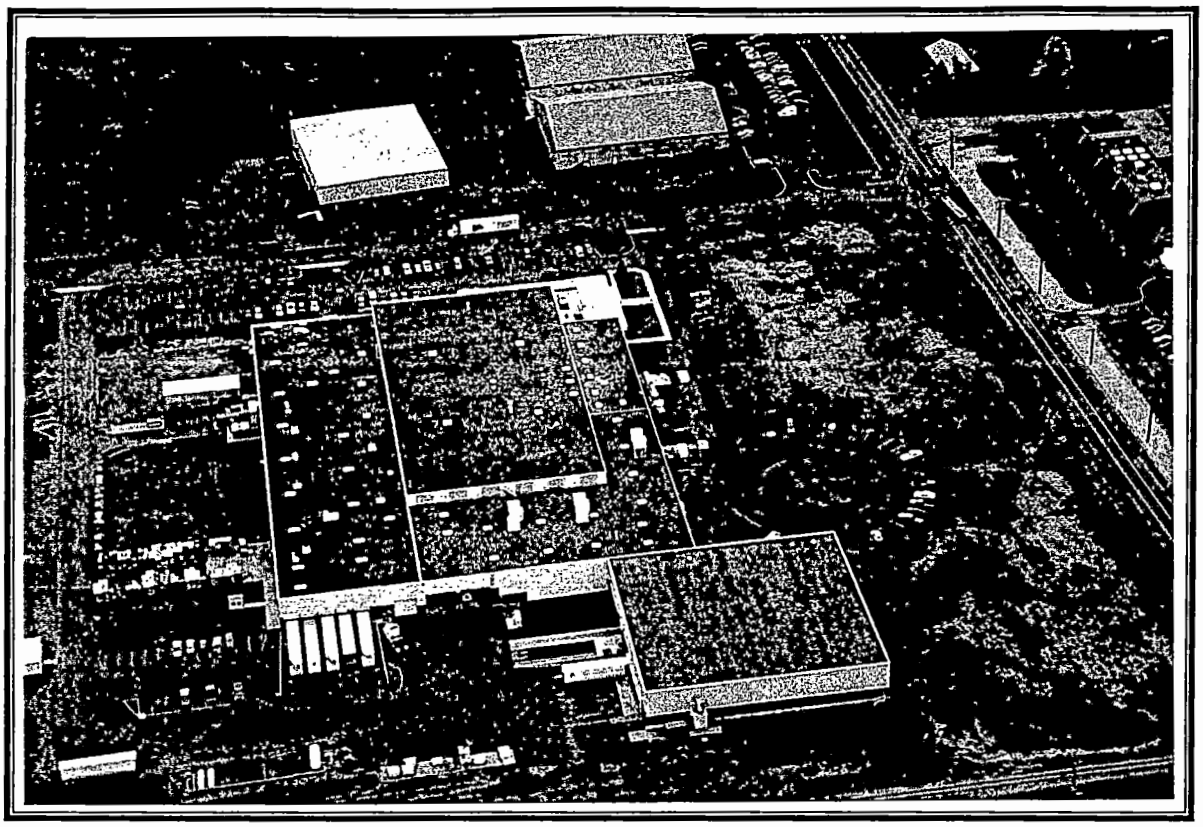

Photo 1: Aerial view of Avery Dennison Facility looking south.

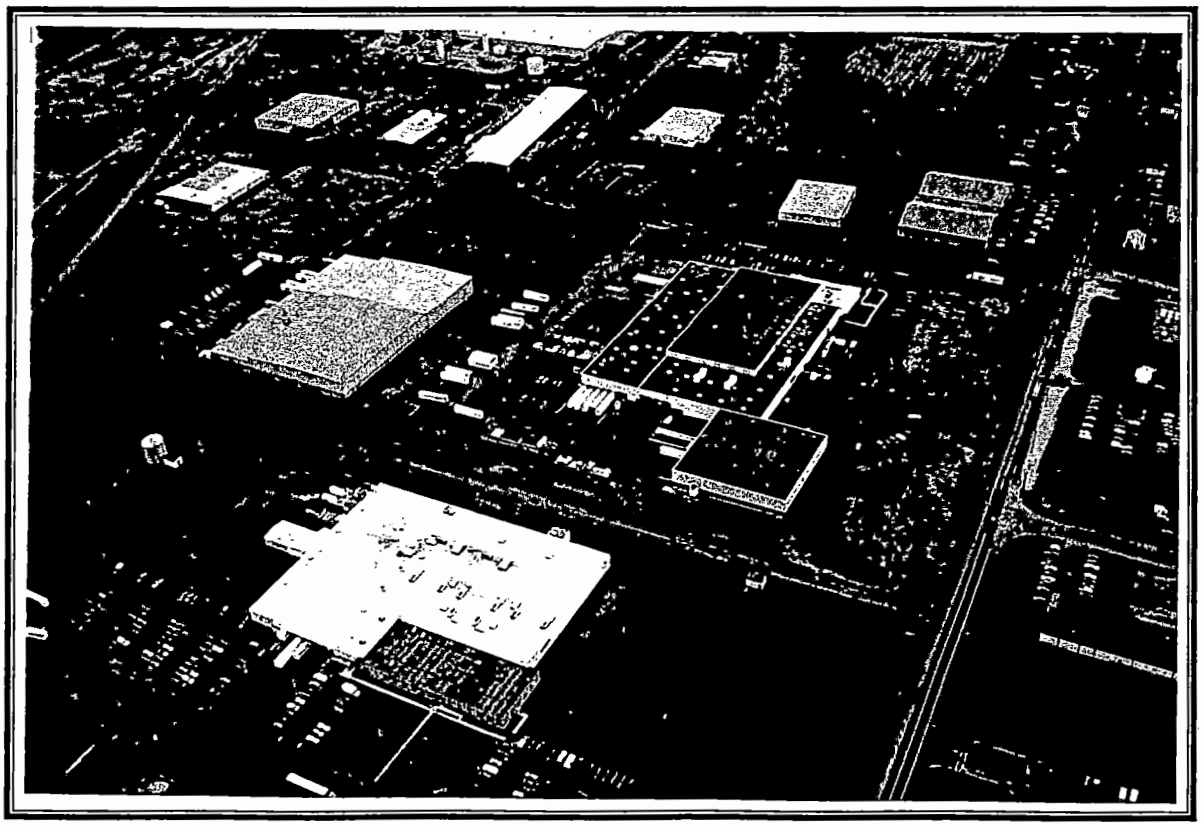

Photo 2: Aerial view of Avery Dennison Facility looking south.

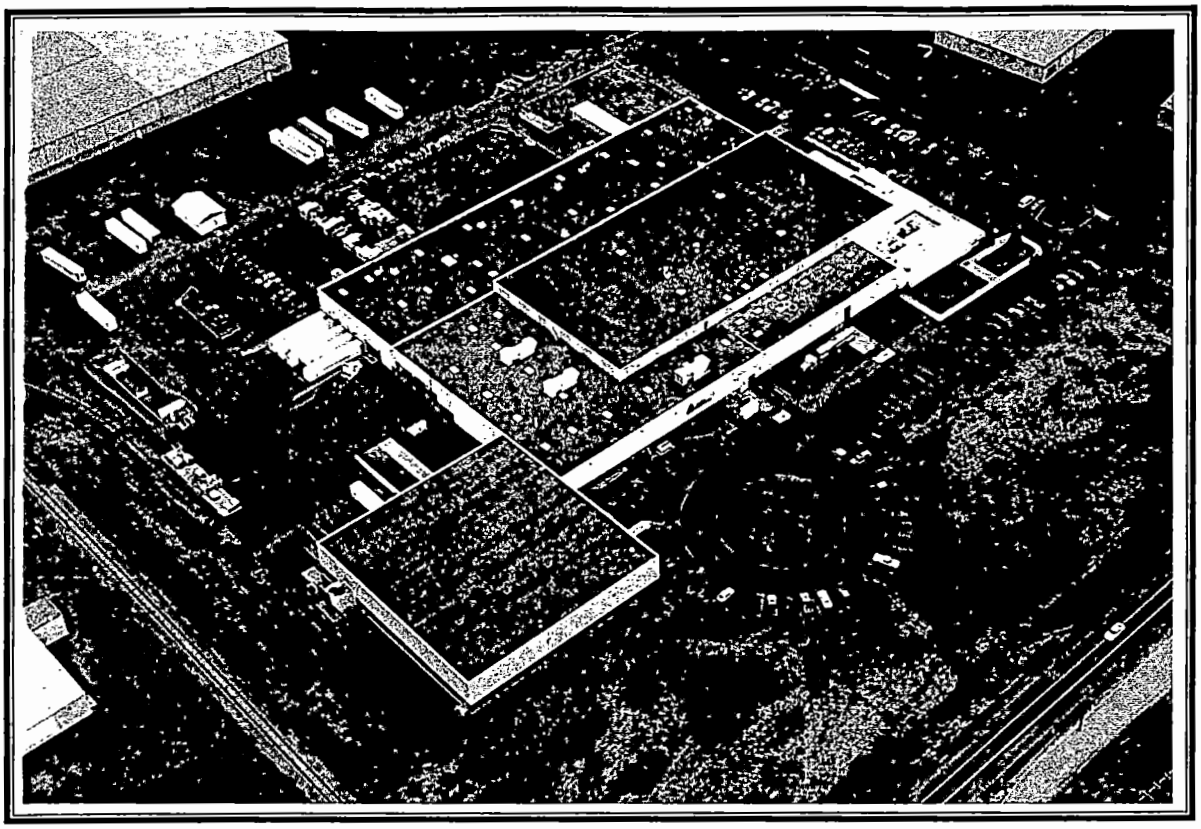

Photo 3: View looking southeast

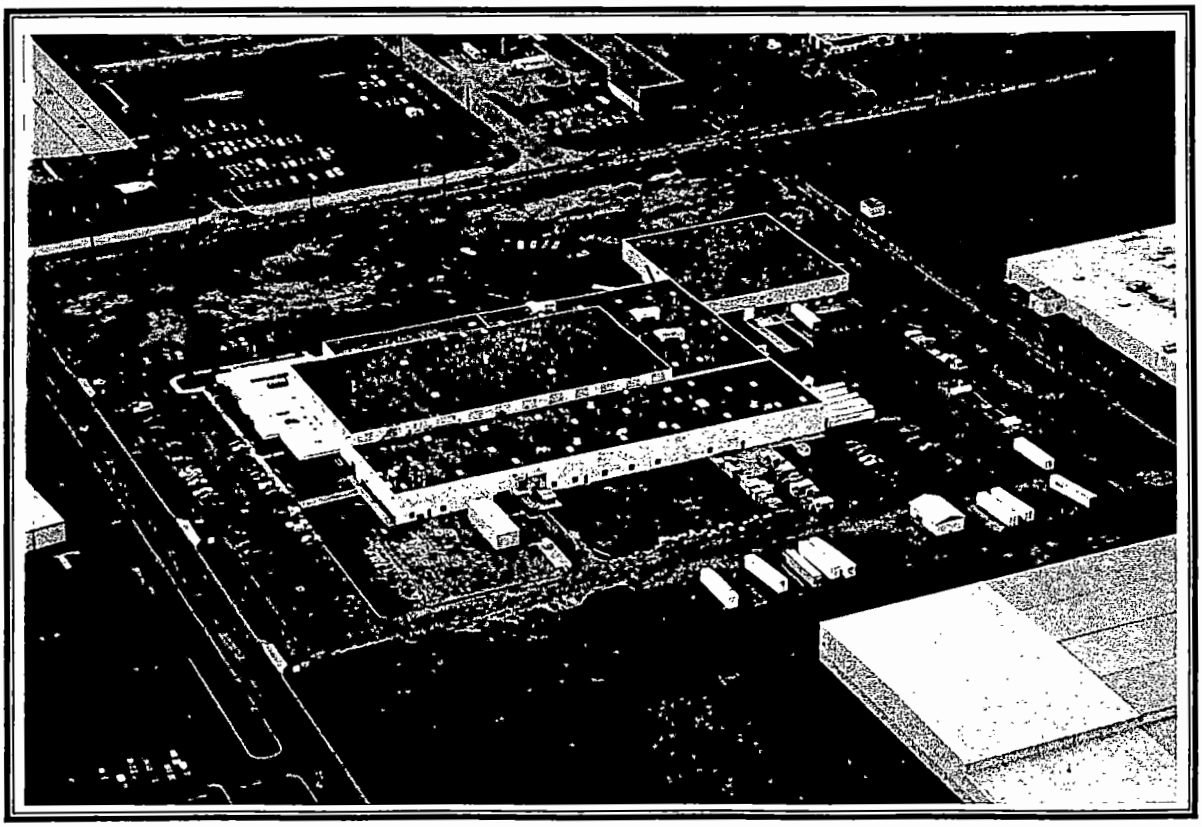

Photo 4: View looking north showing area investigated in foreground.

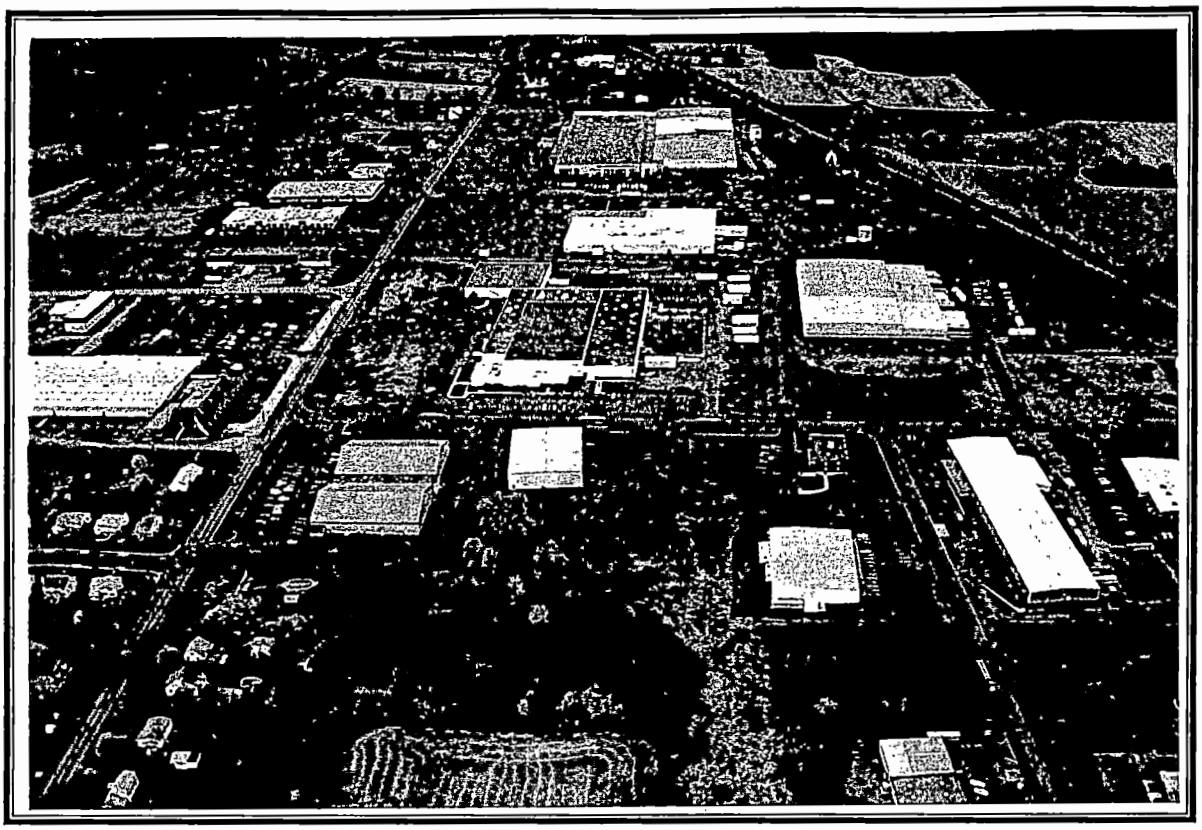

Photo 5: View looking north.

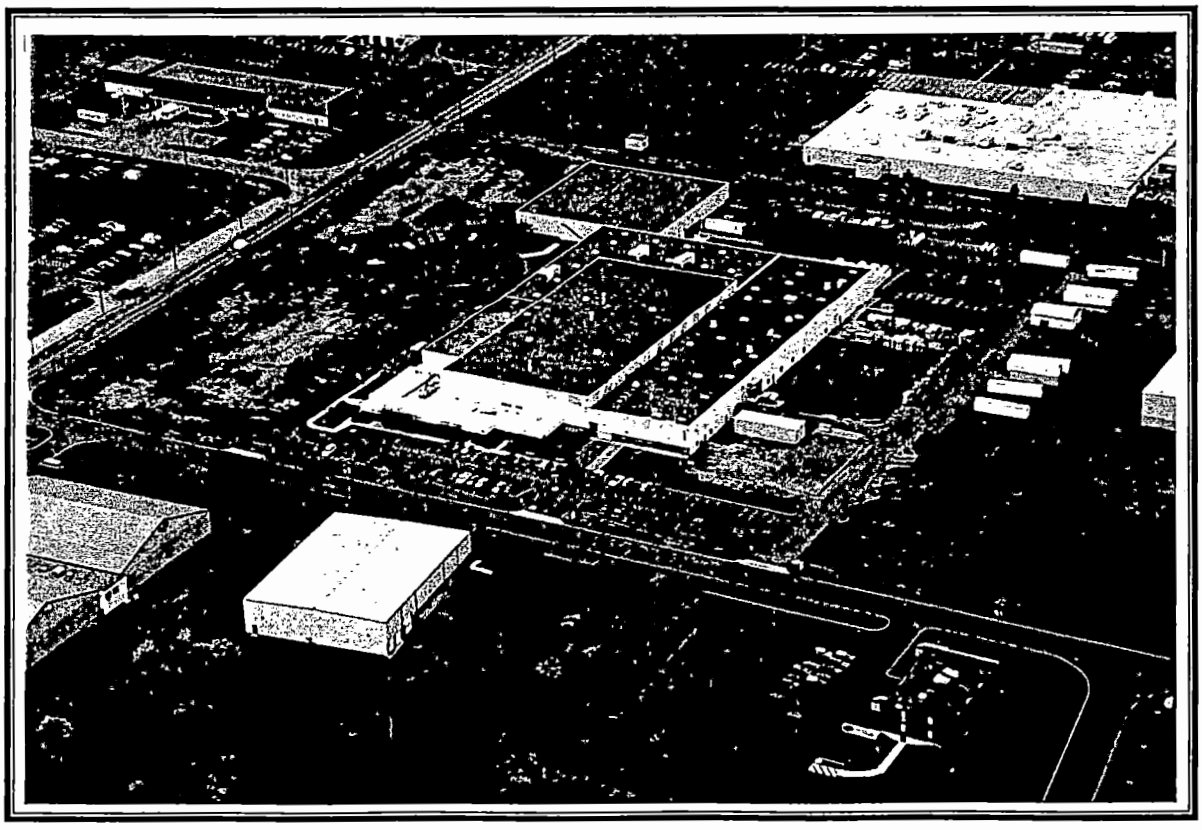

Photo 6: View looking northwest.

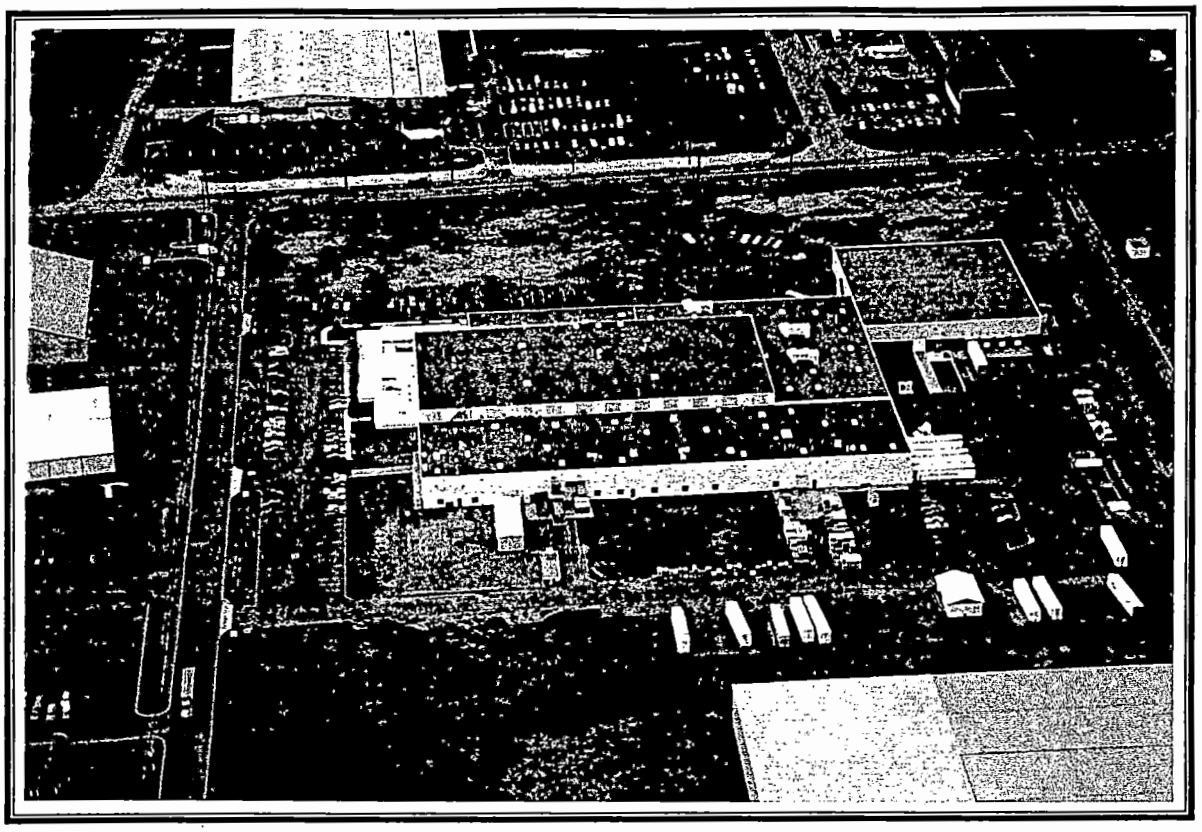

Photo 7: View looking west.

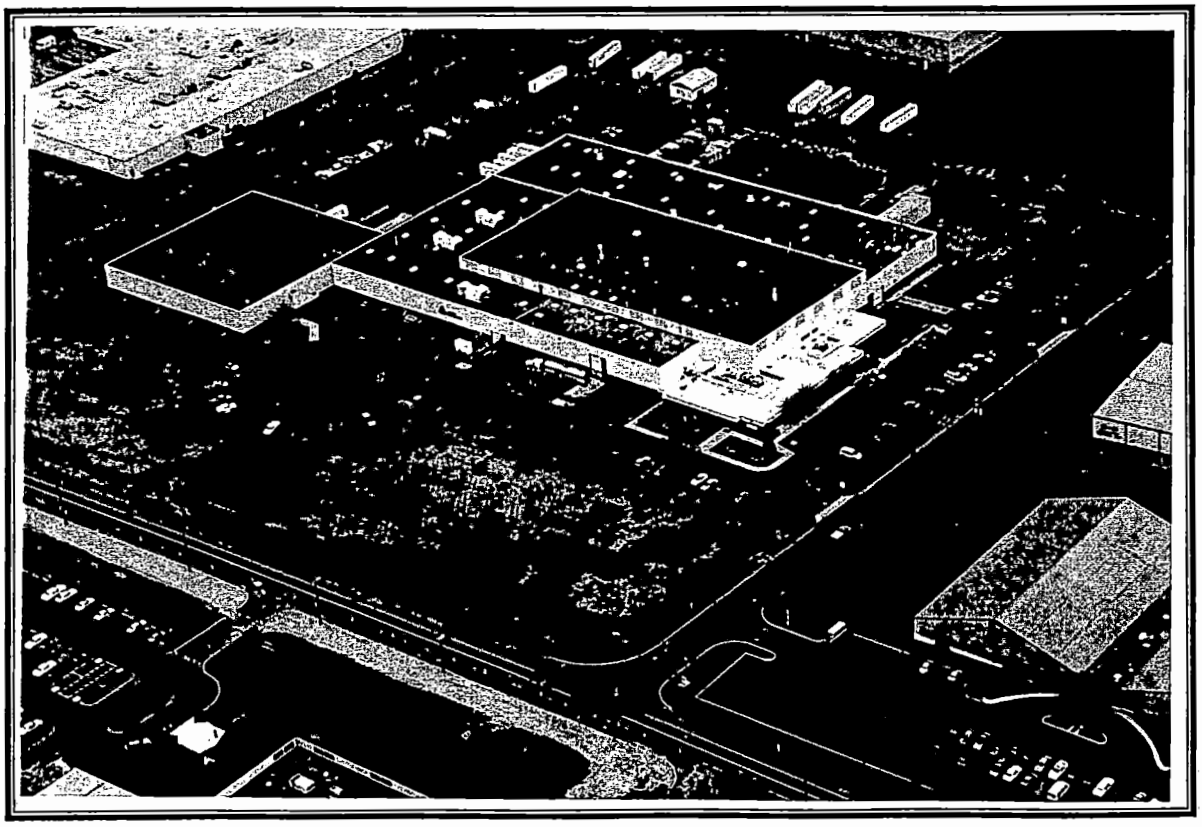

Photo 8: View looking east.

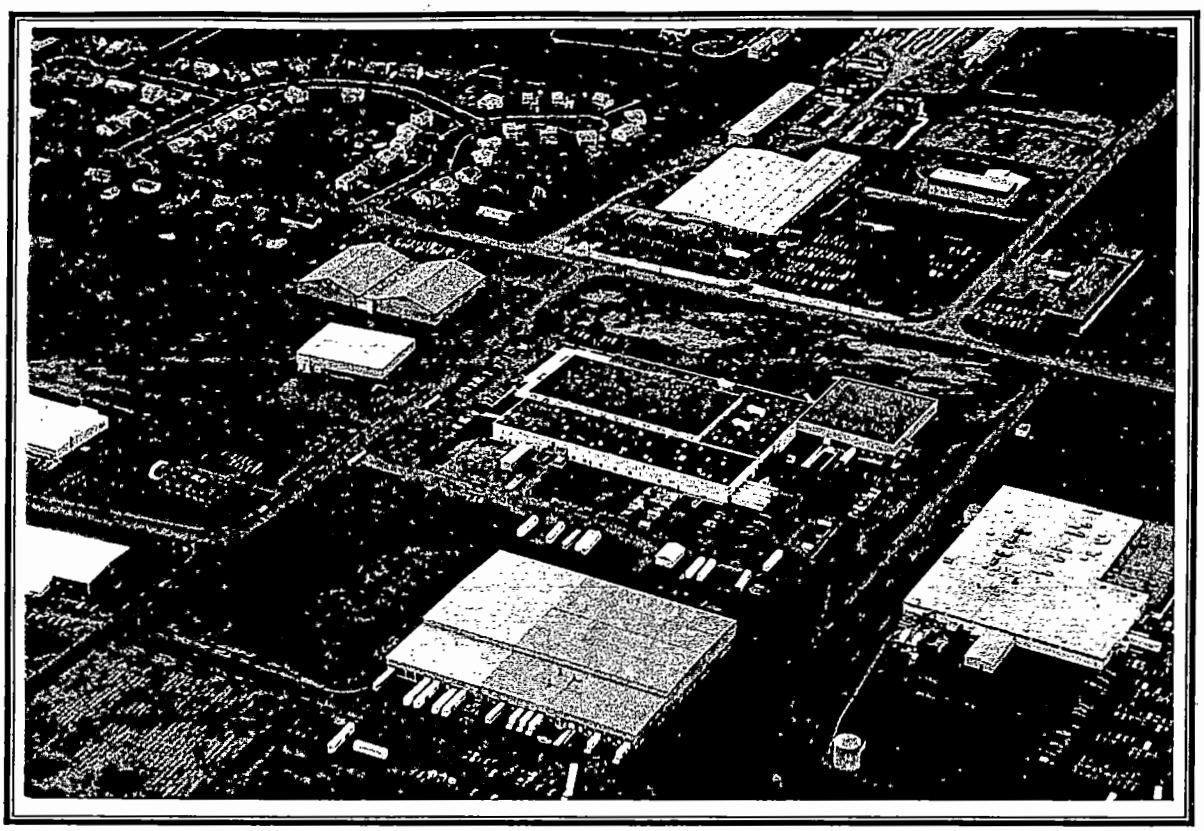

Photo 9: View looking southwest.

Photo 10: View looking south.

APPENDIX B
SOIL BORING LOGS

ENSR

Project Number: 2246-021
Client: Avery Dennison

Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number A-1
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 10 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/24/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/24/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-4': Not sampled	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4				99		moist	0	4'-6': Dense brown clayey SILT, s. trace f/c sand	
5						moist	0	Rolls into 1" long pencils.	
6		A-1				moist	1.2	6'-8': Crumbly red brown clayey SILT, s. f/c sand & f gravel	
7		5.5-6				moist	2.4	shale fragments	
8		A-1		99		wet	3.6	8'-9': Red brown silty CLAY, s. f/c sand & f gravel shale fragments	
9		8-8.5				dry	0.2	fragments	
10		A-1 9.5-10				dry	0	9'-10': Dense, crumbly weathered bedrock	
11								10': Extent of boring at refusal	
12								Soil samples collected at following intervals for on-site analysis:	
13								5.5'-6'	
14								8'-8.5'	
15								9.5'-10'	
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

ENSR

Project Number: 2246-021
Client: Avery Dennison

Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number A-1.5
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 10 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/24/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/24/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-4': Not sampled	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4				99		moist	0	4'-6': Dense brown clayey SILT, s. trace f/c sand	
5		A-1.5 4-4.5					0		
6		A-1.5 5.5-6				moist	0.2	6'-8': Crumbly red brown clayey SILT, s. f/c sand & f gravel shale fragments	
7							0.4		
8		A-1.5 8-8.5		99		moist	0.6	8'-10': Crumbly red clayey SILT, s. f/c sand & f gravel shale fragments fragments	
9						dry	0.1		
10						dry	0.2		
11								10': Extent of boring at refusal	
12								Soil samples collected at following intervals for on-site analysis:	
13								4'-4.5'	
14								5'-5.5'	
15								8'-8.5'	
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

ENSR

Project Number: 2246-021
Client: Avery Dennison
Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number A-2
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 10 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/24/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/24/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-4': Not sampled	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4				99		moist	0	4'-7': Brown and red brown dense silty CLAY, grading into red brown weathered shae bedrock	
5							0		
6						moist	0		
		A-2 6-6.5							
7							0	7'-10': Red brown fissile weathered shale bedrock shale fragments	
8		A-2 7.5-8		99		dry	0		
9						dry	0		
10		A-2 9.5-10				dry	0		
11								10': Extent of boring at refusal	
12								Soil samples collected at following intervals for on-site analysis:	
13								6'-6.5'	
14								7.5'-8'	
15								9.5'-10'	
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

ENSR

Project Number: 2246-021
Client: Avery Dennison
Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number A-5
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 8 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/24/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/24/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
			N/A	N/A	N/A			0-1': Not sampled	No well
1				99		dry	0	1'-3': Red brown clayey SILT, l. f gravel shale fragments	constructed
2		A-5 2.5-3				dry	0		Borehole backfilled with bentonite chips
3						dry	0	3'-6': Brown red weathered silty shale bedrock	and hydrated
4				99		dry	0		
5		A-5 4.5-5				dry	0		
6		A-5 5.5-6				dry	0	6'-8': Competent red shale bedrock	
7						dry	0		
8						dry	0		
9								8': Extent of boring at refusal	
10									
11									
12								Soil samples collected at following intervals for on-site analysis:	
13								2.5'-3'	
14								4.5'-3'	
15								5.5'-6'	
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

ENSR®

Project Number: 2246-021
Client: Avery Dennison

Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number AB-2.5
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 9 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/24/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/24/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-4': Not sampled	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4				99		moist	0	4'-6': Brown clayey SILT	
5						moist	0		
6	▒	AB-2.5				moist	0	6'-8.5': Brown red clayey SILT, s. f/c sand & f gravel shale	
		5.5-6						fragments	
7						moist	0		
8	▒	AB-2.5		99		dry	0		
		7.5-8							
9	▒	AB-2.5						8.5'-9': Weathered shale bedrock	
		8.5-9						9': Extent of boring at refusal	
10									
11									
12								Soil samples collected at following intervals for on-site analysis:	
13								5.5'-6'	
14								7.5'-8'	
15								8.5'-9'	
16									
17									
18									
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28									

ENSR

Project Number: 2246-021
Client: Avery Dennison

Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number **AB-1.5**
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 9 feet
Water Level: Not measured

ject Manager: Ron Carper
Drilling Contractor: EPI
Logged By: James Miller
Driller: Martin Pepper
Date Started: 2/24/99
Date Finished: 2/24/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-4': Not sampled	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4				99		moist	0	4'-6': Brown clayey SILT	
5						moist	0		
6		AB-1.5 5.5-6				moist	0	6'-8.5': Brown red clayey SILT, s. f/c sand & f gravel shale fragments	
7						moist	0		
8		AB-1.5 7.5-8		99		dry	0		
9		AB-1.5 8.5-9						8.5'-9': Weathered shale bedrock 9': Extent of boring at refusal	
10									
11									
12								Soil samples collected at following intervals for on-site analysis: 5.5'-6' 7.5'-8' 8.5'-9'	
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

ENSR®

Project Number: 2246-021
Client: Avery Dennison
Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number B-1
Sheet 1 *of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 10 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/23/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/23/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A		wet	0-4': Not sampled Groundwater encountered 1' below ground surface	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4				99		moist	0	4'-6'9": Brown and red brown silty CLAY, t. f/c sand	
5						moist	2.3		
6		B-1 5'6"-6'0"				moist	0.5		
7						moist	5.6	6'9"-9'8": Red brown SILT, s. f/c sand	
8		B-1 7'6"-8'0"		99		moist	11.2	No odor	
9						dry	3.9	9'8"-10': Weathered shale bedrock	
10		B-1 9'2"-9'8				dry	1.2		
11								10': Extent of boring at refusal	
12								Soil samples collected at following intervals for on-site analysis:	
13								5'6"-6'0" 7'6"-8'0" (Also submitted for off-site laboratory analysis) 9'2"-9'8"	
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

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Project Number: 2246-021
Client: Avery Dennison
Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number B-2
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 10 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/23/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/23/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-4': Not sampled	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4				99		dry	0	4'-6': Brown silty CLAY, gray mottles	
5						dry	0		
6		B-2 5'0"-5'6"				dry	2.2	6'-8'10": Red silty CLAY, s. f/c sand. No odor	
7						dry	4.2		
8				99		moist wet	5.5	Wet 8'-8'10"	
9		B-2 8'0"-8'6"				wet	0.8	9'6"-10': Red, weathered shale bedrock	
10		B-2 9'6"-10'0"				dry dry	2		
11								10': Extent of boring at refusal	
12								Soil samples collected at following intervals for on-site analysis:	
13								5'-5'6"	
14								8'-8'6"	
15								9'6"-10'	
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

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Project Number: 2246-021
Client: Avery Dennison

Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number B-3
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 10 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/23/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/23/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-4': Not sampled	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4				99		wet	0.4	4'-6': Brown f/c silty SAND, l. f gravel	
5						wet	0.2		
6						moist	0.3	6'-6'10": Brown SILT	
7		B-3 6'-6'6"				moist	0.4	6'10"-9': Brown red clayey SILT, s. f/c sand & f gravel	
8		B-3 7'6"-8'		99		moist	0.8		
9						dry	1	9'-10': Red, weathered shale bedrock	
10		B-3 9'6"-10'0"				dry	3		
11								10': Extent of boring at refusal	
12								Soil samples collected at following intervals for on-site analysis:	
13								6'-6'6"	
14								7'6"-8'	
15								9'6"-10'	
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

ENSR

Project Number: 2246-021
Client: Avery Dennison

Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number B-4
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 10 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/23/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/23/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-4': Not sampled	No well constructed
2									
3									Borehole backfilled with bentonite chips and hydrated
4				99		dry	0	4'-6': Green brown grading to red brown clayey SILT, l. f/c sand	
5						dry	0		
6						moist	0	6'-6'10": Green clayey SILT, t. f/c sand	
						wet			
7		B-4 6'5"-6'10				moist	0	6'10"-8': Red SILT	
8		B-4 7'6"-8'		99		wet	5	8'-9': Red brown clayey SILT & f/c sand, t. f gravel Faint volatile odor.	
9						moist	17.4	9'-10': Red, weathered shale bedrock	
10		B-3 9'6"-10'0"				moist	52.4		
11								10': Extent of boring at refusal	
12								Soil samples collected at following intervals for on-site analysis:	
13								6'5"-6'10" 7'6"-8' 9'6"-10' (also submitted for off-site laboratory analysis)	
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

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Project Number: 2246-021
Client: Avery Dennison
Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number B-5
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 8 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/23/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/23/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-1': Not sampled	No well constructed
2				99				1'-4'7": Brown red clayey SILT, t. f/c sand	Borehole backfilled with bentonite chips and hydrated
3		B-5 2'6"-3'0"							
4				99		dry	0		
5		B-5 4'2"-4'7"				dry	0	4'7"-8': Red f/m gravel shale fragments, s. silty clay Weathered bedrock	
6		B-5 5'8"-6'2"				dry	0		
7						dry	0		
8						dry	0		
9								8': Extent of boring at refusal	
10									
11									
12								Soil samples collected at following intervals for on-site analysis:	
13								2'6"-3'0"	
14								4'2"-4'7"	
15								5'8"-6'2"	
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

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Project Number: 2246-021
Client: Avery Dennison

Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number C-3
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 8 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/24/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/24/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-4': Not sampled	No well constructed
2									
3									Borehole backfilled with bentonite chips and hydrated
4				99		wet	0	4'-6'6": Brown clayey SILT	
5						wet	0		
6		C-3				wet	0		
		6-6.5						6'6"-8'6": Red brown clayey SILT, s. f/c sand & f gravel shale fragments	
7						dry	0		
		C-3							
8		7.5-8				dry	0		
		C-3						8'6"-9': Red shale Bedrock	
9		8.5-9							
10								9': Extent of borehole at refusal	
11									
12								Soil samples collected at following intervals for on-site analysis:	
13								6'-6'6"	
14								7'6"-8'	
15								8'6"-9'	
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
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28									

ENSR

Project Number: 2246-021
Client: Avery Dennison

Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number C-4
Sheet 1 *of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 8 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/24/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/24/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	N/A	N/A			0-4': Not sampled	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4				99		wet	0	4'-6': Brown f/c SAND, s. silt, t. f gravel	
5						wet	0		
6		C-4				moist	0	6'-8': Dense red brown clayey SILT, s. f/c sand & f gravel	
7		6-6.5				dry	0	shale fragments	
8		C-4 7.5-8				dry	0	8': Extent of borehole at refusal	
9									
10									
11									
12								Soil samples collected at following intervals for on-site analysis:	
13								6'-6'6"	
14								7'6"-8' (Also submitted for off-site laboratory analysis)	
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

ENSR

Project Number: 2246-021
Client: Avery Dennison
Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number E-1
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 8 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/24/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/24/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1			N/A	99	N/A			0-3'6": Dense brown silty CLAY	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4		E-1		99		wet	1.5	3'6"-3'10": Brown f/m GRAVEL shale fragments, sheen on fragments. Petroleum odor.	
5		3.5-4				wet	1.5	3'10"-6': Dense, red brown silty CLAY. Petroleum odor	
6						wet	4	6'-9'6: Crumbly, red brown silty CLAY, s. f/c sand & f gravel shale fragments. Petroleum sheen on shale fragments.	
7		E-1 6-6.5				wet	4		
8						wet	4		
9									
10		E-1 9.5-10				moist	16.6	9'6"-10': Weathered red shale bedrock. Petroleum saturated soil immediately above bedrock.	
11								10': Extent of borehole	
12								Soil samples collected at following intervals for on-site analysis:	
13								3'6"-4' 6'-6'6" (Also submitted for off-site laboratory analysis) 9'6"-10'	
14									
15								Petroleum product globules observed on geoprobe drive shaft upon removal.	
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

ENSR

Project Number: 2246-021
Client: Avery Dennison
Site: Avery Dennison Fasson Roll Division Facility
35 Penn Am Drive
Quakertown, Pennsylvania

Boring Log

Boring Number E-2
Sheet 1 *Of* 1
Equipment: Geoprobe
Sampling Method: 4' Macrocore
Depth of Boring: 8 feet
Water Level: Not measured

Project Manager: Ron Carper
Logged By: James Miller
Date Started: 2/24/99
Drilling Contractor: EPI
Driller: Martin Pepper
Date Finished: 2/24/99

Classification of Material
f-fine f/m-fine to medium a.-and (20-35%)
m-medium f/c-fine to coarse s.-some (20-35%)
c-coarse m/c-medium to coarse l.-little (10-20%)
All capital letters-50%+ t.-trace (1-10%)

Depth (ft)	Sample Depth (ft)	Sample Number	Blow Count	Recovery (%)	Sorting	Moisture	PID (ppm)		Details
1				99		dry		0'-5': Brown clayey SILT, t. f/c sand & f gravel shale fragments	No well constructed
2									Borehole backfilled with bentonite chips and hydrated
3									
4				99					
5						dry	0	Soil as above. Petroleum odor observed. No sheen observed.	
6		E-2 5.5-6				wet	0	6'-9'6: Crumbly, red brown silty CLAY, s. f/c sand & f gravel shale fragments.	
7						wet	0.5		
8		E-2 7.5-8				wet	11.4		
9							10.1		
10		E-2 9.5-10				moist	1	9'6"-10': Weathered red shale bedrock.	
11								10': Extent of borehole at refusal	
12								Soil samples collected at following intervals for on-site analysis:	
13								5'5"-6'	
14								7'6"-8'	
15								9'6"-10'	
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									